

MONTHLY WEATHER REVIEW,

JUNE, 1880.

(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In preparing this REVIEW the following data, received up to July 13th, have been used, viz the regular tri-daily weather charts, containing the data of simultaneous observations taken at 139 Signal Service stations and 14 Canadian stations, as telegraphed to this office; 147 monthly journals and 159 monthly means from the former, and 14 monthly means from the latter; reports from 24 Sunset stations; 221 monthly registers from Voluntary Observers; 41 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers in, and the local Weather Service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

The general distribution of the atmospheric pressure, as reduced to sea-level, for the month of *June*, 1880, over the United States and Canada is shown by isobaric lines on chart No. II. At a few outlying stations the barometric means are given in figures (English inches.) The region of greatest pressure (over 30.05 inches) includes the South Atlantic and East Gulf States, while the least pressures (below 29.80) are found at Pembina, Omaha and along the eastern slope of the Rocky Mountains from Nebraska to the interior of Texas.

Departures from the Normal Values for the Month.—As compared with the average of the means for the months of June for the past eight years, those for the present month (June, 1880) show a remarkable uniformity. East of a line running along the Mississippi valley from Louisiana to Missouri and thence north-eastward to Alpena, Mich., except at Wood's Holl, Portland and Eastport, on the eastern coast of New England, the departure is slightly above the normal. It amounts to 0.05 inch at Cincinnati, 0.04 at Nashville, and less than the latter amount elsewhere. Along the immediate eastern coast of New England and west of a line drawn as above, the departure is below the normal and amounts to only 0.03 inch at Wood's Holl, Escanaba, Davenport, Santa Fé, Cheyenne and Pembina, 0.04 at Omaha and Virginia City, and 0.05 at North Platte, Denver and Salt Lake City.

Barometric Ranges.—The local barometric range, as reduced to sea-level, is marked by great irregularity over the United States east of the Rocky Mountains. Along the Gulf coast it is very small, amounting to 0.24 inch at Key West, 0.29 at Punta Rasa and 0.31 at New Orleans. From these stations northward to Iowa, Wisconsin, Michigan, Ohio, Virginia and North Carolina there occurs a rapid increase in the range, which at Omaha amounts to 1.15 inch; Des Moines, 1.29; Madison, 1.26; Marquette, 1.19; Grand Haven, 1.08; Cleveland, 0.78; Lynchburg, 0.71, and Charlotte, N. C., 0.70. North and westward of the region of greatest range, namely, Iowa and Wisconsin, a rapid decrease occurs, and at Pembina and Cheyenne the ranges are 0.61 and 0.49, respectively. Over Pennsylvania, Maryland and Delaware the range is comparatively small (0.60 inch at Washington, D. C.), but thence northeastward it increases to 0.90 at Boston and 0.91 at Eastport, Me.

This Paper is furnished by the Government of the United States, without charge to the Co-operating Observers acting with the Signal Office in the collection of Simultaneous Reports.

Areas of High Pressure.—Apart from the general and permanent area of high pressure which, during June, prevails over the South Atlantic slope, but three different areas of high pressure have been sufficiently marked to merit description. Nos. I and II are the usual outflows of cold, dry air southeastward from the Saskatchewan region, while No. III appears to have been an encroachment of the high pressure of the Pacific Ocean.

No. I.—This area, central the morning of the 1st in the Lower Missouri valley, moving slowly eastward, covered the Ohio valley and Lower Lake region during the 2nd, and the Atlantic States during the 3rd. On the morning of the 4th the highest pressure of the area was reported from the Canadian Maritime Provinces: Father Point barometer, 30.31, or 0.45 above the normal. During the 5th and 6th the area gradually withdrew eastward in advance of low area No. II. After the passage of low area No. II the pressure increased in the Canadian Maritime Provinces and covered those provinces, New England and the Middle Atlantic States, until the 10th, after which it dissipated. Except in the Gulf and a portion of the South Atlantic States, the passage of the area was marked by the minimum temperatures of the month for the entire country east of the Rocky Mountains. Frost was reported from scattering stations in Dakota, Nebraska and Wisconsin during the 1st; from New York, 2nd to 4th and Pennsylvania, 4th. Cautionary Off-shore Signals were displayed from afternoon till midnight of the 1st, from Boston southward to Chincoteague, Va., and Cautionary Signals along the Carolina coast from the 1st to the 3rd, and on the Virginia and New Jersey coasts during the 2nd. The signals—at a few stations somewhat late—were generally justified. The following maximum wind velocities were reported: Barnegat, N. 35; Chincoteague, N.E. 35; Delaware Breakwater, N. 42, and Kittyhawk, N.E. 44.

No. II.—From midnight of the 14th until the morning of the 16th the pressure steadily increased in the Northwest, the maximum pressure of the area occurring at the latter date at Duluth—barometer 30.28, or 0.36 above the normal. The centre of the area, with nearly unchanging pressure, remained in the Lake region from the 16th to the 19th, while the pressure in the Atlantic States rose considerably above the normal during that time. The area gradually dissipated during the 20th and 21st. During the continuance of this area the minimum temperatures of the month occurred at most stations in the Gulf and at many in the South Atlantic States. The signals ordered in the Lake region for low area No. VI remained displayed (except on Lake Superior) in connection with this area until midnight of the 15th, when they were lowered, having been fully justified, as shown elsewhere.

No. III.—During the 18th this area appeared on the California coast, and gradually moving northeastward during the 19th covered the entire Pacific slope, and extended eastward into the Plateaux districts. During the 20th it slowly dissipated. On the morning of the 20th frost, destructive to vegetation, was reported at Boise City, Idaho; frost and ice at Winnemucca, Nev., and at Yreka, Cal., crops and fruit were badly injured by heavy frost, while ice formed in places. The highest pressure occurred at Red Bluff, Cal., the afternoon of the 19th; barometer 0.36 above the normal.

Areas of Low Pressure.—Thirteen areas are described, ten of which have been charted. No area has been charted entirely across the continent. The areas have been generally ill-defined and of but little energy. No. II and VI are the only areas which crossed any portion of the country with well-defined centres. No. II was a storm of unusual violence and duration for June.

No. I.—This area, a continuation of No. X of the May REVIEW, during the 1st passed from the St. Lawrence valley eastward over the Atlantic Ocean.

No. II.—During the 2nd and the morning of the 3rd the pressure gradually decreased on the northern Rocky Mountain Slope; on the afternoon of the latter day the barometer at Fort Keogh was 0.27 below the normal. Moving southeastward, the area was central the afternoon of the 4th in the Lower Missouri valley; Omaha barometer 29.25, or 0.50 below the normal. During the preceding eight hours an abnormal barometric fall of over 0.10 inch occurred over the greater part of the Lower Missouri and Upper Mississippi valleys, while exceedingly heavy rains fell in Minnesota. During the day violent local storms occurred as follows: at St. Louis one person was killed, several buildings blown down and much damage to property done, both in the city and south of it; the wind attained a velocity of S. 52 miles at 11 a. m. in St. Louis. At and near Milwaukee the wind attained a velocity of SW. 60 miles at 2.30 a. m. Three vessels were dismasted a short distance outside the harbor and several others damaged in canvas and spars. From that afternoon until the afternoon of the 5th the centre remained stationary in the Lower Missouri valley, with steadily decreasing pressure; Omaha barometer at latter date 29.05, or 0.71 below the normal. During the preceding twenty-four hours, brisk southerly winds, high temperatures and heavy rainfalls prevailed in the Upper Mississippi valley, while to the westward and northward of the Lower Missouri valley, high northerly winds, low temperatures and heavy rainfalls were reported. At Omaha, at 6 p. m. of the 5th, the barometer touched 28.85—its lowest point—and half an hour later the wind veered suddenly from SW. to NW., and reached a velocity of 60 miles. At midnight of the 5th the storm was central in eastern Missouri; Des Moines barometer 28.97. Moving northeastwardly, on the afternoon of the 6th the central area was in northern Michigan; Escanaba barometer 29.09, or 0.76 below the normal. During the night of the 5th and 6th the storm was unusually severe over Lake Erie and the entire Upper Lake region. Moving from Michigan in a northeasterly course, parallel to the St. Lawrence valley, the central area passed into the Province of Quebec

during the 7th. In connection with the passage of this area occurred exceedingly heavy rainfalls from the 3rd to the 6th, in Wisconsin and northern Michigan, which greatly damaged crops, flooded the country generally, and swept away over fifty million feet of lumber in Wisconsin. Cautionary Signals were ordered for the entire Upper Lake region at noon of the 4th, for Lake Erie the morning of the 5th, and for Lake Ontario the afternoon of the 6th; they were lowered on Lakes Superior and Michigan on the morning of the 6th and later in the day in the rest of the Lake region. These signals were fully justified by unusually high winds from the 4th to the 7th. The following maximum velocities were reported: Duluth, NW. 31; Rochester, W. 32; Alpena, SE. 33; Chicago, W. 36; Grand Haven, SE. 40; Toledo, SW. 42; and Milwaukee, W. 48. During the 5th and 6th Cautionary Signals were displayed along the Atlantic coast from Sandy Hook southward to Cape Lookout. These signals were all justified by maximum velocities ranging from SE. 30 at Sandy Hook, and SW. 30 at Cape Lookout to SE. 39 at Delaware Breakwater.

No. III.—The centre of this area was apparently on the coast of British Columbia on the morning of the 7th, at which time the barometer at Olympia was 29.74, or 0.34 below the normal. The advance of this area produced general rains in the North Pacific Coast region during the 6th and 7th. Following a course a little S. of E., its centre on the afternoon of the 8th was in Dakota; Fort Buford barometer 0.47 below the normal. Changing its course northeastward, by the morning of the 9th it had passed into Manitoba.

No. IV.—This area appears to have sprung up from the remains of area No. III. As the central part of that area passed northeastward into Manitoba during the night of the 8th, a considerable area of depression existed in the Middle Rocky Mountain region, where it remained—nearly unchanged—until midnight of the 10th, when a sharp barometric fall occurred in Colorado; Denver barometer 0.35 below the normal. During the 11th it passed northeastward, and by midnight was in the valley of the Red River of the North. Thence moving in an easterly course across the Lake region, it merged during the 13th with the remains of low area No. V, and formed an extensive area of low pressure which covered the Atlantic slope from North Carolina to Nova Scotia, the pressure along the immediate coast from New England northward being 0.50 below the normal. During the 14th the area moved eastward over the Atlantic Ocean. No signals were displayed in connection with the passage of this area. During the 12th and 13th frequent cases of high winds were reported from the Lake region and the Atlantic coast from North Carolina northward.

No. V.—In the afternoon of the 11th a sharp barometric fall was reported from New England and the St. Lawrence valley, at which time the area was apparently central in the Province of Ontario. On the morning of the 12th the area was central in New Brunswick; Eastport barometer 0.34 below the normal. During the 12th the pressure steadily decreased in New England and the Canadian Maritime Provinces; Sydney barometer, the morning of the 13th, 0.50 below the normal. The subsequent description of this area is given as that of No. IV, with which it united on the 13th. No signals were displayed and no dangerous winds reported in connection with this area.

No. VI.—During the 13th the pressure decreased slowly in the Lower Missouri valley, forming a decided depression by the morning of the 14th, when the Leavenworth barometer stood at 29.50, or 0.35 below the normal. Moving directly eastward the centre was in the Mississippi valley that afternoon—St. Louis barometer 0.37 below the normal—and by midnight reached southwestern Ohio. During the 13th and 14th, in connection with this area and advancing high area No. II, heavy rainfalls occurred in the greater part of the Upper Mississippi and Ohio valleys, causing numerous local floods and doing great damage to crops. Central the morning of the 15th in West Virginia, it moved thence southeastward and during that night passed off the North Carolina coast over the Atlantic Ocean. During the afternoon of the 13th Cautionary Signals were ordered for the Upper Lake region, and during the 14th for Lake Erie. The following maximum wind velocities were reported: Detroit, SW. 28; Toledo and Chicago, NE. 32; Milwaukee, NE. 34; Sandusky, NE. 37. On the morning of the 14th Cautionary Signals were displayed along the Atlantic Coast from Cape Lookout northward to Sandy Hook. They were all justified by maximum wind velocities ranging from E. 25 at Atlantic City and NW. 28 at Cape May to NE. 35 at Delaware Breakwater, NE. 40 at Cape Lookout and NE. 44 at Kittyhawk.

No. VII.—During the 20th the pressure fell steadily over the St. Lawrence valley, where this area was central at midnight of the 20th. Moving slowly southeastward through Maine during the 21st, it passed off the Nova Scotia coast the afternoon of the 22nd, at which time Halifax barometer stood at 29.52, or 0.38 below the normal. During the 21st and 22nd northwesterly winds, ranging from 26 to 40 miles, were reported from various stations on the New England and New Jersey coasts. No signals were displayed during the passage of this area.

No. VIII.—From midnight of the 21st until the morning of the 24th, an ill-defined area of low pressure prevailed over Louisiana and southern Texas, disappearing on the latter date. Its centre was probably in the western part of the Gulf of Mexico. The only high wind—probably local—reported, was E. 29 at New Orleans, the afternoon of the 22nd. No signals were necessary, and none were ordered, during the passage of this area.

No. IX.—This area gradually developed in northern Minnesota or Manitoba during the 22nd. Mov-

ing in an easterly course it passed over Lake Superior during the 23rd, and was central the morning of the 24th in Ontario, whence by a southeasterly path it passed off the Maine coast at midnight of the latter date. No signals were displayed during its passage. The area was one of but little energy; high winds (from 25 to 27 miles) occurred only at three widely separated stations in the Lake region.

No. X.—During the 23rd the pressure steadily decreased on the North Pacific coast. On the morning of the 24th the barometer at Portland, Or., was 0.23 below the normal. The pressure remained slightly below the normal until the 30th. During the prevalence of this area no rain fell on the Pacific coast.

No. XI.—Apparently central at midnight of the 23rd in Manitoba the centre of this area moved south-eastward and remained over the Lake Superior region during the 24th. Central the morning of the 25th in northern Michigan, it reached the valley of the St. Lawrence by midnight, and passing down that valley it disappeared over the Gulf of St. Lawrence on the 26th. No signals were displayed during the passage of this area. But four cases of brisk winds, at widely separated stations, were reported during its passage.

No. XII.—This area, central in Manitoba the morning of the 26th, reached eastern Minnesota at midnight. Moving slowly in an easterly course, it was central over the Upper Lake region until the 28th, on the afternoon of which day it reached the province of Ontario and thence passed down the valley of the St. Lawrence. Brisk SW. winds, ranging from 26 to 30 miles, were generally reported from the Lower Lake region on the 28th. On the Atlantic coast Cautionary Signals were ordered on the afternoon of the 28th from Portland, Me., to Chincoteague, Va. The signals were lowered the next morning, having been justified by velocities ranging from SW. 26 at Barnegat, to N. 29 at Cape May, and SW. 31 at Thatcher's Island.

No. XIII.—From midnight of the 29th the pressure fell from Kansas to Texas until midnight of the 30th, at which time the barometer at Dodge City was 0.19 below the normal.

INTERNATIONAL METEOROLOGY.

Three International Charts, Nos. IV, V and VI, accompany the present REVIEW. They are for the months of May, 1880, and October, 1878.

On Chart No. IV will be found the probable course of the principal low pressure areas over the North Atlantic Ocean during the month of May, 1880. As during the preceding month (*April*, 1880) the weather over the North Atlantic has continued remarkably fine and free from severe or protracted storms. The month opened with a belt of high pressures extending over Europe, from the Black Sea to the British Isles and France, and thence over the Atlantic to Newfoundland and the Bermudas; on the 1st, over the western portion of the Atlantic, barometric readings above 30.40 in. or 772.1 mm., were reported over a region extending from 50° N. 25° W. to 35° N. 53° W. Ship *Hippolyta*, in 42° N. 45° W., on the southeastern margin of this ridge of high pressures, reported, during the night of April 30th and May 1st, a very heavy N. to E. gale, with high sweeping sea: from 2 to 3 a. m. the gale was furious, force 11, but moderated towards day-break. From the 1st to the 11th this area of maximum pressures appears to have moved northeastward, with more or less regularity, and on the latter date to have covered northwestern Europe and the Atlantic for some distance to the westward, over which latter region high pressures continued until the 17th, and caused the continued northeasterly winds which prevailed during this period (10th to 17th) over the Eastern Atlantic near the parallel of 50° N. The first protracted storm of the month followed the track shown on the present chart as area No. I, and was fully described as low area No. I in the May REVIEW. On the 7th it passed eastward over Newfoundland, and on the 8th was encountered by *S. S. Nederland* in 43° N. 42° W., barometer 29.86 or 758.4, temperature 62° Fahr., wind SSW., force 4, high SSW. sea. On the 9th it was followed over this region by a return to high pressure and a rapid fall in temperature; the *Nederland*, in 41° N. 47° W., reported barometer 30.19 or 766.8, temperature 46° Fahr., NNW. 2. It is probable that this low area remained during the 9th and 10th near 50° N. 40° W., and is the same as that to be described as area No. IV, but reports at present to hand do not warrant the joining of the two tracks. The second storm (No. II, Chart IV,) apparently developed off the coast of Portugal on the 4th, and subsequently moved eastward over the Mediterranean. On the 8th a small depression (No. III, Chart IV,) was central to the southwest of Ireland, which subsequently moved southeastward over the Bay of Biscay and southern France. Ship *Hippolyta* reported, "on the 8th, in 49° N. 15° W., 8 p. m., strong NE. gale, force 11, and high cross-sea; midnight (8th-9th) gale moderating." No. IV appeared over mid-ocean on the 11th. On the 12th and 13th, U. S. S. *Saratoga*, near the Azores, recorded the following very low pressures for this region: 12th, 39° N. 24° W., 29.43 or 747.5, calm, heavy rain-squalls; 13th, 39° N. 20° W., 29.49 or 749.0, WSW. force 7, fair. On the 14th, the easterly winds on the northern margin of this area increased in force and *S. S. Indiana*, in 51° N. 15° W., recorded ESE. 8, barometer 29.89 or 759.2. On the 16th, the barometer at the Madeiras (Funchal) read 29.61 or 752.0, and from the 17th to the 21st this area appeared to spread eastward over the Mediterranean to the Black Sea region. No. V is a continuation of low area No. IV, already described in the May REVIEW; on the 14th, *S. S. Scythia*, in 41° N. 59° W., reported barometer 29.67 or 753.6, wind NNW. 4, light rain, and on the 16th, in 44° N. 45° W., 29.35 or 745.4, WSW. 9, heavy rain, heavy swell from WSW. High winds, occasionally described as of hurricane force, were experienced over the western portion of the Atlantic during the 15th and 16th, but by the 17th only moderate gales. During the 18th and 19th there was a gradual return to high pressures, and very low temperatures were recorded; thus, on board the *S. S. Hibernian*, the thermometer fell from 40° F. on the 17th, in 49° N. 39° W., to

30° F. on the 19th in 47° N. 51° W., and on board the *S. S. Celtic*, from 54° F. on the 16th in 46° N. 40° W. to 33° F. on the 18th in 42° N. 52° W. During the 17th the area of high pressures over northwestern Europe and adjacent portions of the Atlantic Ocean commenced to move in rear of low area No. IV. Until the 23rd this movement was southerly over the eastern Atlantic Ocean towards the Spanish Peninsula, after which high pressures spread eastward over southern Europe. Low areas Nos. VI and VII moved eastward to the north of the British Isles on the 23rd and 26th, respectively, the former being followed by westerly gales to the west of Ireland—*S. S. Britannic* on the 23rd, 51° N. 23° W., reported barometer 29.85 or 758.1, wind W., force 7, rain, heavy WNW. swell. From the 26th to the 29th, low pressures also prevailed in the region of Newfoundland, but as far as present reports show were not accompanied by high winds.

The following account of a severe storm off Buenos Ayres is reported by *U. S. S. Marion*: "February 14th, 1880, 35° 56' S. 53° 28' W., 4 p. m., barometer 29.77 falling, NE. moderate breeze, threatening. 15th, 36° 23' S. 54° 08' W., wind increasing in heavy rain-squalls, force 3 to 6 from NE. until 3 a. m., barometer 29.54, when the wind hauled to N. and W.; noon, barometer 29.35, wind NW., 6 to 7; 2 p. m., barometer 29.26, lowest reading, wind W. by N., 5 to 8; 4 p. m., barometer 29.32, wind SW. by S., 7 to 9; hove to in 37° S. 54° 16' W.; 4 to 8 p. m., wind SW. by S., force 7 to 10; 8 p. m., barometer 29.41, wind SW., force 10 to 11; ship laboring in heavy, rough, confused sea; 9 p. m. to 2 a. m., of 16th, barometer rising from 29.40 to 29.62, wind WSW., 8 to 10. 16th, 2 a. m. to 1 p. m., wind SW. by W., subsiding in squalls; 1 p. m., barometer 29.91, wind SW., force 6, clear sky and rough sea."

Chart No. V shows, by isobaric and isothermal lines, the mean pressure and temperature, and, by small arrows, the prevailing direction of the wind, at 7:35 a. m., Washington mean time, over the Northern, and portions of the Southern Hemispheres, for the month of October, 1878. The barometer observations have been corrected for temperature and reduced to sea level. At stations lying outside the area included within the lines, and for those in the Southern Hemisphere, the means are shown by figures indicating the temperature in degrees, Fahrenheit, and the pressure in English inches. Upon comparing the *distribution of atmospheric pressure* for the month (October, 1878,) at present under consideration, with that for the preceding month (September, 1878,) the most marked changes are found to be a continued and large increase in pressure over the whole of Asia, including Japan, and the eastern and extreme southern portions of Europe, and a remarkable decrease over western Europe, eastern half of North America (except near the Gulf of Mexico) and over almost the whole of the North Atlantic. A decided increase, however, is found over Sweden and Norway (except extreme southern portions), Iceland and southern Greenland—the region of maximum decrease during September. The increase of pressure over the various regions referred to above, amounts to 0.15 inch at Godthaab, 0.17 at Stykkisholm, about 0.10 in northern portions of Norway and Sweden, northern and western Russia, and from the Black Sea to Tunis, while over southeastern Russia and thence eastward to Japan it is about 0.25. It amounts to 0.32 at Barnaul, 0.28 at Zi-Ka-Wei, 0.26 at Nagasaki and 0.20 at Tokio. In Hindostan it ranges from 0.08 at Belgaum and Chittagong to 0.11 at Sibsagar and 0.18 at Lahore, and at Nikolaievsk on the Amoor the increase amounts to 0.05. The decrease over the Atlantic and neighboring land areas amounts to about 0.12 for the region of the Great American Lakes to Newfoundland, gradually increasing thence eastward until it reaches 0.30 over the eastern Atlantic from 45° to 55° N. and 10° to 20° W.; over the British Isles it is 0.31 at Valentia, 0.19 at Great Yarmouth and 0.18 at Sandwick; thence northward, eastward and southward, it gradually, but rapidly, falls to 0.11 at Thorshavn and 0.06 at Copenhagen and Madrid. The most important change in the distribution of pressure is thus seen to be a large decrease (0.30 inch) over the northeastern Atlantic Ocean (*i. e.* to the west of France and Ireland) and a corresponding increase over central Asia. The general direction of the *winds* during October, 1878, at 7.35 a. m., Washington mean time, may be summarized as follows: From the Rocky Mountains to Hudson's Bay, along the immediate North American coast, from Chesapeake Bay to Cape Cod, and over the centre of the Atlantic, *northwesterly*; from Texas and the interior of the Gulf States to the Lakes and St. Lawrence valley, and from the Azores and Madeiras to the Faröe Islands and thence over nearly the whole of Europe and northern Asia, *southwesterly*; in Iceland, southern Greenland, Newfoundland and thence to the West Indies and Florida, *northeasterly*. In Hindostan, calms predominated, except the continued westerly monsoon on the Bombay coast, (rainfall at Bomba 4.92 and Belgaum 6.64 inches,) and over the Gulf of Bengal. Along the Japan and China coasts the northeast monsoon was fully established, the direction being northerly at Tokio, northeast at Shanghai and east at Hong Kong. Over the regions of southerly winds the mean *temperature* of the month was generally above the normal; thus, in the St. Lawrence valley, the temperature was 5° above the mean; in Ireland and southern England 3° to 3.5 above; and in Germany, at Freiburg, and in eastern Russia, at Penza, nearly 6° above.

On chart No. VI are traced the paths of twenty-eight of the principal storm-areas which traversed the the Northern Hemisphere during the month of October, 1878. Nine of them, namely Nos. II, IV, VII, VIII, XI, XII, XV, XVIII and XXVI, originated to the south of the 30th parallel, while the rest probably developed over the temperate zone and moved in a general easterly course. The most violent storms of the month, in connection with these areas, may be briefly summarized as follows. As area No. I moved slowly eastward, from the 1st to the 7th, it was attended by hurricane winds over the Atlantic, between the parallels of 40° and 50° N. No. II, the continuation of No. XXI of the September, 1878, chart, moved from the region of the Bahamas on the 1st, northeastwards between the Bermudas and Newfoundland to the British Isles by the 10th, as a severe tropical cyclone; during the 8th, however, the region of low pressure

increased in area and the attending winds became somewhat less violent. No. III caused the following high velocities in the Behring's Sea region: St. Michael's, 6th, E. 52 miles; St. Paul's Island, W. 45, and Unalaska Island, terrific SW. gale. No. IV, a typhoon moving westward from the Philippine Islands to Hainan. U. S. Flagship *Monocacy*, stationed at Hong Kong, reported in connection with this storm as follows: "On the 8th, a very heavy gale was experienced in the vicinity of Hong Kong, evidently due to a moderate typhoon, the centre of which was passing in a southwesterly direction along the coast of China, leaving Hong Kong on its right; incoming vessels reported very heavy gales south of Formosa on the 7th and off Hainan on the 9th; numerous vessels dismasted and several wrecked." Much damage resulted at Hong Kong, Canton and Macao. No. V was attended by a destructive tornado in Iowa and by damaging winds in the Lake region and St. Lawrence valley during the 8th and 9th, and by heavy gales over the Atlantic, between 40° and 60° N., from the 10th to 13th. No. VII moved rapidly from the Gulf of Mexico on the 10th and was accompanied by hurricane winds from the 11th to the 14th between the American coast and the Bermudas; at Cape Lookout the anemometer measured a velocity of 72 miles per hour, from the N.E., on the 11th, and on the evening of the 12th a severe thunderstorm passed over the Bermudas, during which 2.62 inches of rain fell in two hours. Off the New England and Nova Scotia coasts the storm was exceedingly severe and numerous disasters to shipping resulted. Nos. XI and XII, hurricanes over the Atlantic. No. XVIII, in its passage from Cuba to New England, is one of the severest storms on record; at Havana the wind increased to 35 miles, with violent gusts; at Key West to 46 miles; at Cape Lookout to 100 miles; at Philadelphia and Barnegat to 72 miles; on summit of Mount Washington to 120 miles, and at Portland, Me., (anemometer cup blown away,) estimated, 70 miles. An immense amount of damage to property resulted from this storm. No. XXI, with its subsidiary centres of depression, was attended by severe winds over northwestern Europe from the 22nd to the 30th. No. XXV was attended by very severe winds over Behring's Sea: St. Paul's Island, W. 60 miles, and St. Michael's, E. 37. No. XXVI was attended by very low pressures over an extensive area, reaching from Japan to Behring's Sea, during which the barometer fell to 29.62 at Tokio and 29.08 at Nikolaeivsk on the Amoor on Oct. 29th; to 28.93 at St. Paul's Island on the 31st, and to 29.08 at St. Michael's on Nov. 2nd.

TEMPERATURE OF THE AIR.

The mean temperatures for June, 1880, are shown by isotherms on Chart No. II. The table of average temperatures on that chart shows that east of the Rocky Mountains an excess of temperature generally prevailed, while to the westward deficiencies occurred. The greatest excess prevailed in the Upper Lake region (2.8 above the normal) and thence eastward to the Atlantic ocean. Deficiencies were reported from the entire Pacific slope and the Plateau districts, reaching 2.9 in the northern Pacific coast region, and 3.8 in the northern Plateau district.

Maximum and Minimum Temperatures.—Upon charting the maximum temperatures for June, 1880, great irregularities appear. In general they range from 85° to 95°. Temperatures at or above 100° have been reported from nearly every station in Arizona and the Rio Grande valley. Unusually high temperatures were reported as follows: 100° at Jacksonville, Charleston, S. C., Savannah, Wilmington, Ft. Elliott, Tex., and Ft. Keogh, Montana; 101° at Norfolk; 102° Dodge City, 103° at Umatilla—the only station on the Pacific slope exceeding 99°. The highest temperature reported was 117° at Phoenix, Arizona. The following stations reported *maxima* under 85°: Escanaba, 84°; Wood's Holl and Los Angeles, 83°; San Francisco, 82°; Milwaukee, 81°; Buffalo, 80°; Eastport, 79° and San Diego, 73°; Mt. Washington, 63; Pike's Peak, 58°. Minimum temperatures above 70° were reported from Key West (73°) and the lower Rio Grande valley. The following stations report temperatures under 37°: Apache, Ariz., and Olympia, 36°; Pembina, 35°; Pioche, 34°; Santa Fé and Deadwood, 33°; Prescott, Ariz., 32°; Campo, Cal., and Helena, Mont., 31°; Virginia City, M. T., 30°; Winnemucca, 29°; Mt. Washington, 28 and Pike's Peak, 8°. The following list shows the maximum and minimum temperatures in each State and Territory:

Maximum Temperatures.—*Maine:* 96° at *Cornish, 90° at Portland and 79° at Eastport. *New Hampshire:* 98° at *Dunbarton and *Grafton, and 63° on the summit of Mt. Washington. *Vermont:* 95° at *Charlotte, 93° at *Windsor and 89° at Burlington. *Massachusetts:* 99° at *Westborough, 94° at Springfield and 93° at Boston. *Rhode Island:* 89° at *Ft. Adams and 86° at Newport. *Connecticut:* 95° at *Mystic and 92° at New Haven. *New York:* 98° at *Schroon Lake, 95° at *Ardenia, 92° at New York City and 91° at Albany. *New Jersey:* 100° at *Atco, 99° at *Linden and 93° at Sandy Hook, Barnegat and Atlantic City. *Pennsylvania:* 97° at *Milton and Pittsburg, 95° at *Wellsboro, and 94° at *Chambersburg and Philadelphia. *Delaware:* 92° at *Dover. *Maryland:* 95° at Baltimore. *District of Columbia:* 96.5° at Washington. *Virginia:* 101° at Norfolk. *West Virginia:* 89° at Morgantown and Helvetia. *North Carolina:* 103° at *Weldon and 100° at Wilmington. *South Carolina:* 100° at Charleston. *Georgia:* 100° at Savannah. *Florida:* 104° at *Houston and 100° at Jacksonville. *Alabama:* 98° at Montgomery. *Mississippi:* 94° at Vicksburg. *Louisiana:* 94° at *Point Pleasant and 93° at Shreveport. *Texas:* 108° at Eagle Pass, 106° at Stockton and 100° at Fort Elliott. *Ohio:* 95° at *Bellefontaine and 93° at Cincinnati. *Kentucky:* 94° at Louisville. *Tennessee:* 96° at Knoxville, Nashville and Memphis. *Arkansas:* 92° at Little Rock. *Michigan:* 94° at Marquette, 91° at Detroit. *Indiana:* 98° at *Laconia and 91° at Indianapolis. *Illinois:* 97° at Peoria and 93° at Cairo. *Missouri:* 95° at *Pierce City and 93° at St. Louis. *Kansas:* 102° at Dodge City and 90° at Leavenworth. *Wisconsin:* 94° at Edgerton and 90° at La Crosse. *Iowa:* 96° at *Glenwood and 93° at Dubuque and Des Moines. *Nebraska:* 100° at

*Genoa and 97° at Omaha. *Indian Territory*: 94° at Ft. Sill. *Minnesota*: 88° at St. Paul. *Dakota*: 95° at Deadwood and Ft. Buford. *Colorado*: 106° at *Ft. Lewis, 96° at Denver. *New Mexico*: 104° at La Mesilla. *Wyoming*: 100° at *Ft. Fetterman and 97° at Cheyenne. *Utah*: 93° at Salt Lake City. *Nevada*: 94° at Winnemucca. *Arizona*: 117° at Phoenix, 114° at Florence, and 110° at Tucson, Yuma and Burkes. *Idaho*: 91° at Boise City. *Montana*: 100° at Ft. Keogh. *California*: 99° at Visalia and Red Bluff, and 73° at San Diego. *Oregon*: 103° at Umatilla. *Washington Territory*: 90° at Olympia.

Those marked with a star (*) are reported by U. S. Army Post Surgeons or Voluntary Observers.

Minimum Temperatures.—*Maine*: 41° at *Orono and 43° at Eastport. *New Hampshire*: 28° on the summit of Mt. Washington, 38° at *Dunbarton and *Grafton. *Vermont*: 40° at *Lunenburg and 41° at Burlington. *Massachusetts*: 42° at *South Lee and 48° at Boston. *Rhode Island*: 49° at Newport. *Connecticut*: 46° at *Mystic and 47° at New Haven. *New York*: 38° at *Schroon Lake and 42° at Buffalo. *New Jersey*: 46° at *Dodge Mine. *Pennsylvania*: 37° at *Dyberry and 49° at Pittsburg. *Delaware*: 56° at *Dover. *Maryland*: 45° at *Woodstock, 52° at Baltimore. *District of Columbia*: 49° at Washington. *Virginia*: 42° at *Mt. Solon and *Wytheville, and 49° at Lynchburg. *West Virginia*: 38° at *Helvetia and 46° at Morgantown. *North Carolina*: 48° at *Franklin and 52° at Charlotte. *South Carolina*: 62° at Charleston. *Georgia*: 58° at Atlanta. *Florida*: 65° at Cedar Keys. *Alabama*: 68° at Mobile, Montgomery and *Green Spring. *Mississippi*: 63° at Vicksburg. *Louisiana*: 63° at Shreveport. *Texas*: 44° at Ft. Elliott, 53° at Stockton and 72° at Laredo. *Ohio*: 44° at *Westerville and 46° at Cleveland. *Kentucky*: 52° at Louisville. *Tennessee*: 52° at Knoxville. *Arkansas*: 50° at *Mt. Ida and 60° at Little Rock. *Michigan*: 37° at Marquette and 46° at *Lansing. *Indiana*: 50° at *New Harmony and *Laconia, and 54° at Indianapolis. *Illinois*: 43° at *Marengo and 52° at Chicago. *Missouri*: 44° *Pierce City and 57° at St. Louis. *Kansas*: 45° at *Wellington and 57° at Dodge City. *Wisconsin*: 36° at *Ashland, 48° at La Crosse. *Iowa*: 42° at *Nora Springs, 50° at Dubuque. *Nebraska*: 42° at North Platte. *Indian Territory*: 55° at Ft. Sill and Fort Gibson. *Minnesota*: 37° at Breckenridge. *Dakota*: 33° at Deadwood, 39° at Ft. Buford. *Colorado*: 8° on summit of Pikes Peak, 19° at *Summit and 24° at *Ft. Garland. *New Mexico*: 33° at Santa Fé. *Wyoming*: 30° at *Ft. Fetterman and 37° at Cheyenne. *Utah*: 40° at Salt Lake City. *Nevada*: 29° at Winnemucca. *Arizona*: 32° at Prescott. *Idaho*: 40° at Boise City. *Montana*: 38° at Ft. Keogh. *California*: 31° at Campo, and 47° at Red Bluff and Visalia. *Oregon*: 37° at Roseburg. *Washington Territory*: 36° at Olympia.

Those marked with a star (*) are reported by U. S. Army Post Surgeons or Voluntary Observers.

Ranges of Temperatures at Signal Service Stations.—The monthly ranges will appear from the maxima and minima just given. The greatest daily ranges vary in New England from 17° on the summit of Mt. Washington, to 30° at Springfield and Boston, and 33° at Burlington; Middle Atlantic States, 20° at Cape May, to 26° at Albany and 31° at Norfolk; South Atlantic States, 14° at Cape Lookout, to 21° at Jacksonville, and 28° at Wilmington and Smithville; East Gulf States, 16° at Key West, to 24° at Mobile and Montgomery, and 26° at Pensacola; West Gulf States, 15° at Galveston, to 26° at Little Rock and 29° at Corsicana; Ohio valley and Tennessee, 21° at Cairo, to 28° at Pittsburg, and 29° at Nashville and Knoxville; Lower Lake region, 21° at Sandusky, to 29° at Rochester; Upper Lake region, 21° at Chicago, to 28° at Marquette and Alpena; Upper Mississippi valley, 21° at Davenport, to 25° at St. Louis and 30° at St. Paul; Red River of the North valley, 31° at Pembina, to 36° at Breckenridge; Missouri valley, 25° at Leavenworth, to 32° at Omaha and Bismarck, and 33° at Yankton; Texas, 27° at San Antonio and Denison to 42° at Ft. Elliott; Eastern Rocky Mountain slope, 29° at Ft. Sill, to 38° at Deadwood and 40° at North Platte; Rocky Mountains, 29° at summit of Pike's Peak, to 40° at Santa Fé and 45° at Cheyenne; Middle Plateau District, 36° at Salt Lake City, to 39° at Boise City, and 51° at Winnemucca; California, 22° at San Francisco, to 37° at Red Bluff, and 40° at Visalia.

Frost.—*Wisconsin*—Embarrass, 1st. *Dakota*—Pembina, 1st. *Nebraska*—Austin, 1st, injuring vegetation slightly; North Platte, 28th, "light hoar frost." *Pennsylvania*—Dyberry, 4th. *California*—Ft. Bidwell and Salinas City, 18th; Yreka, 19th, "seriously damaging fruit and growing crops;" Campo, 23d, 24th, heavy, 25th. *Colorado*—Pike's Peak, 22d, 25th. *New York*—Waterburg, 2nd, 3rd, 4th; Palermo, 2nd, 3rd; North Volney, 2nd, 4th; Niles, 2d. *Washington Ty.*—Olympia, 15th. *Vermont*—Woodstock, 3d, slight. *Utah*—Coalville, 11th, hoar.

Ice.—Winnemucca, Nev., 5th, 10th, 20th. Yreka, Cal., 19th, "in some localities."

PRECIPITATION.

The general distribution of the rain-fall, for June, 1880, is shown on chart No III, as accurately as possible from about 500 reports. In a table on this chart will be found the average precipitation for June, as compared with that of the present month. The rain has been unusually local in its character. The greatest deficiency (Lower Missouri valley, 3.02 inches) occurred adjacent to the greatest excess, (2.40 inches) in Minnesota. The other great departures from the normal reported, are: New England, 2.01 inches deficient; South Atlantic States, 2.78 deficient; Upper Lake region, 1.49 excess, and Western Gulf States, 1.52 excess. For the fifth successive month marked deficiencies have been reported from the greater part of the Atlantic slope. Since January 1st, 1880, the rain-fall has been deficient on that slope as follows: New England, 3.44 inches; Middle Atlantic States, 4.93 in., and South Atlantic States, 5.72 in. In connection with this deficiency serious droughts are reported in New Jersey, portions of New York and

Pennsylvania, and of less severity from the interior of New England. Exceedingly heavy rains in the Upper Mississippi and the Ohio valleys, at various times during the month caused extensive freshets, which are elsewhere noted in detail.

Special Heavy Rains.—1st, Denison, Tex., 3.36 inches. 3rd, Cedar Keys, Fla., 2.98; Rock Island, Ill., 3.74. 4th, Independence, Ia., 3.00; Manhattan, Kan., 2.28; Breckenridge, Minn., 2.77; Dubuque, Ia., 2.95; Davenport, Ia., 3.50; Lawrence, Kan., 1.80, 2 hours and 45 minutes; Le Claire, Ia., 2.94; 4th and 5th, Duluth, Minn., 3.02. 5th, Monticello, Ia., 2.75; Northpoint, Mich., 5th to 7th, 6.70, 5.20 in one day; Alpena, Mich., 5th and 6th, 2.83. 6th, Marquette, Mich., 2.45. 9th, Oregon, Mo., 2.07; 9th and 10th, Embarrass, Wis., 4.30. 11th, Baltimore, 2.66; Duluth, Minn., 2.80; Norfolk, 11th and 12th, 3.30. 13th, Rockford, Ill., 2.89; Vevay, Ind., 1.85 in one hour; Ft. Hartsuff, Neb., 3.97; 13th and 14th, Lansing, Mich., 3.96; Ponca, Nebr., 4.75; Helvetia, W. Va., 3.08. 14th, Cumberland, Md., 3.60; Madison, Wis., 3.47; Cincinnati, 2.62; Bethel, Ohio, 3.85; near Cincinnati 4.00, 1 inch fell in 30 minutes and 3 inches in 3 hrs. 15th, Cape Hatteras, N. C., 2.95; New Geneva, Pa., 3.03; Confluence, Pa., 2.20. 21st, Silver City, N. M., 0.93; Fall river, Mass., 0.67 in 15 minutes. 23rd and 24th, Thomasville, Ga., 2.55; 23rd, Galveston, 2.55 in 4 hrs 15 min.; 23rd and 24th, Ft. Wallace, Kan., 5.37. 24th, Galveston, 2.56 in 8 hrs; Helena, Ark., 2.00. 25th, Detroit Mich., 1.56 in 8 hrs. 26th, Stockton, Tex., 1.09 in 22 min. 27th, Corning, Mo., 1.45 in 10 min.; Lynchburg, 1.00 in 20 min. 28th, Anna, Ill., 2.50; Denison, Tex., 3.60; Melissa, Tex., 2.00 in 6 hrs. 29th, Ft. Elliott, Tex., 2.40; Wellsburg, W. Va., 2.37 in 21 hrs; Evansville, Ind., 2.50. 30th, Yates Centre, Kan., 1.00 in 1 hour; Cape Lookout, N. C., 4.04; Creswell, Kan., 3.50 in 1½ hour; Ashwood, Tenn., 1.30 in 90 minutes.

Largest Monthly Rainfalls.—Mt. Auburn, Ohio, 13.47 inches; Embarrass, Wis., 11.40; Northport, Mich., 11.01; College Hill, Cincinnati, 10.50; Duluth, 10.40; Dennison, Tex., 10.00; Cincinnati, Signal Station, 9.86; Madison, Wis., 9.31; Bethel, Ohio, 9.25; Wellsboro, Pa., 9.09; Ft. Wallace, Kan., 8.94; Cincinnati (Woodward High School) 8.79; Cedar Keys, Fla., 8.76; Cresco, Ia., 8.75; Cape Hatteras, 8.59; Ft. Hartsuff, Neb., 8.52; Alpena and Indianapolis, 8.48; Jacksonburg, Ohio, 8.35; Galveston, 8.33; Guttenburg, Ia., 8.06; Breckenridge, 7.90; Spiceland, 7.83; New Geneva, Pa., 7.69; Stanley, Ontario, 7.59; Helena, Ark., 7.47; Davenport, 7.21.

Smallest Monthly Rain-falls.—Alcatraz, San Buenaventura, Pt. San Jose, San Geronio, Princeton, Salinas City, Lompoc, San Francisco, Los Angeles, Red Bluff, Sacramento and Visalia, Cal., Winnemucca, Nev., and Yuma, Ariz., none; Burkes and Tucson, Ariz., La Mesilla, N. M., and El Paso, Tex., trace; Salt Lake City, 0.01 inches; Pioche, Nev., 0.03; Hermosa, Col., and Prescott, Ariz., 0.04; Florence, Ariz., 0.05; Laredo, Tex., 0.09; Boise City, 0.11; Eagle Pass, Tex., 0.12; Ft. Fred Steele, Wyo. Ty., 0.14; Ft. McDermitt, Nev., 0.15; Ft. Verde, Ariz., 0.16; Ft. Garland, Col., 0.18; Ft. Wingate, N. M., 0.19; Ft. Douglass, Utah, 0.22; Ft. Hall, Idaho, Ft. Union, N. M., and Battle Creek, Mich., 0.25; Ft. Bidwell, Cal., 0.26; Summit, Col., 0.28; Hector, N. J., 0.40; Ft. Apache, Ariz., and Helena, Mont., 0.46.

Rainy Days.—The number of days on which rain or snow has fallen, varies as follows: New England, 9 to 18; Middle Atlantic States, 6 to 15; South Atlantic States, 5 to 13; Eastern Gulf States, 8 to 19; Western Gulf States, 8 to 20; Ohio valley and Tennessee, 8 to 15; Lower Lake region, 12 to 16; Upper Lake region, 10 to 20; Upper Mississippi valley, 11 to 15; Missouri valley, 10 to 14; Red River of the North valley, 11 to 15; Eastern Rocky Mountain Slope, 4 to 12; Rio Grande valley, 1 to 4; Plateau districts, 0 to 9; California, 0 to 1; Oregon, 6 to 14.

Cloudy Days.—The number varies in New England from 5 to 11; Middle Atlantic States, 3 to 10; South Atlantic States, 2 to 11; Eastern Gulf States, 7 to 9; Western Gulf States, 0 to 8; Ohio valley and Tennessee, 4 to 11; Lower Lak region, 4 to 14; Upper Lake region, 8 to 16; Upper Mississippi valley, 7 to 11; Missouri valley, 4 to 12; Red River of the North valley, 6 to 8; Eastern Rocky Mountain Slope, 0 to 12; Rio Grande valley, 1 to 4; Plateau districts, 0 to 5; California 0 to 10; Oregon, 10 to 19.

Hail.—Ft. Hale, Dak., 23rd, stones weighing seven and one half ounces. Ft. Meade, Dak., 11th, 22nd. Ft. Niagara, N. Y., 30th. Ft. Concho, Tex., 6th. Ft. Fetterman, Wyo. Ty., 4th, 13th, 30th. Southington, Conn., 13th. Lyndon, Ill., 29th, fields of corn entirely destroyed and osage hedges stripped of their leaves; hail fell in such quantities that it was found the next day in small ravines. Laconia, Ind., 28th. Monticello, Ia., 5th, 13th. Guttenburg, Ia., 28th. Yates Center, Kans., 8th. Gardiner, Me., 21st. Fallston, Md., 12th, 25th. Rowe, Mass., 20th. Thornville, Mich., 2nd. Genoa, Neb., 5th, 11th. Princeton N. J., 21st. Ardenia, N. Y., 21st. Westerville and Jacksonburg, Ohio, 13th. Dyberry, Pa., 16th, (21st did much damage to crops.) Catawissa, Pa., 11th. Ashwood, Tenn., 30th. Salt Lake City, 4th. Pike's Peak, 20th, 22nd. Chyenne, 12th, 17th. Ft. Gibson, 7th, severely injuring vegetation, stones half inch in diameter. North Platte, 23rd, 30th. Stockton, Tex., 9th, (26th, size of walnut.) Cedar Keys, Fla., 3rd. Keokuk, 29th. Breckenridge, 4th, 22nd. St. Paul, 4th, one half inch in diameter, Milwaukee, 2nd, completely covered ground; considerable damage to vegetation. Charlotte, N. C., 29th. Augusta, Ga., 30th. Philadelphia, 21st. Albany, 20th. Mt. Washington, 16th.

Snow.—Utah, Ft. Douglass, 4th, 9th, "few flakes." California, 18th, Ft. Bidwell, Yreka, Red Bluff, "seen on high peaks of Sierra Nevada and Coast range." Oregon, 18th, Umatilla, "fell on Butter Creek hills, nine miles south of station." Colorado, Pike's Peak, 5th, 18th, 21st, 23rd, "heavy snow storm with

much electricity" 24th to 27th, 29th. *Nebraska*, North Platte, 27th, "few flakes." *New Hampshire*, Mt. Washington, 16th.

Floods.—The following is a brief account of the extensive floods of the upper Mississippi and the Ohio valleys during June, 1880. *Bellevue, Ia.*, 4th, Maquoketa river running over its banks causing great destruction to property, a large boom at the city broke sending adrift thousands of logs, and also one at Moore's mill entailing a large loss. One steamer and a barge sunk near the city. All railroad communication seriously obstructed and one railroad bridge swept away. *La Crosse, Wis.*, 11th, five million feet of logs carried away by high water; loss \$40,000. 17th, Mississippi river rose 13 inches in past 21 hours, water higher than since 1858; travel between North Side and Vine street depot obstructed by water to the depth of two feet, no trains arrived for 36 hours. *Galena, Ill.*, 11th, Commerce and Washington streets nearly submerged, water around Barrows and Taylor's mill five to six feet deep. Water rose steadily in the river at the rate of half a foot an hour. *Cincinnati*, 14th, many cellars were flooded and streets badly washed; along the river, which rose eight feet in five hours, considerable lumber and merchandise were washed away. The damage to Miami canal was very severe. At Glendale, near Cincinnati, the entire portion of the city near the depot was flooded in less than twenty minutes. In several streets the water was waist deep and little streams in the vicinity of Mill creek were enlarged from 3 to 200 feet, and at some parts swollen to a depth of twelve feet. *Jones Station, Butler county, Ohio*, 14th, destruction to crops by water very great, hundreds of acres through the valley submerged. At Le Soudsville crops seriously damaged. At Port Union, large field of grain washed away, loss estimated at tens of thousands of dollars. At Overpecks Station, great damage to crops; many large bodies of water formed in vicinity. As far as Seven Mile the same disastrous results were reported. Nearly all of the railroads in Butler, Hamilton, and Clermont counties, Ohio, were seriously damaged; miles of track, heavy embankments and trestles were washed away. Several bridges were severely injured or carried away. *Baltimore, Md.*, 12th, very heavy rain, several streets badly washed, culverts broken, cellars flooded and street railway travel seriously interfered with. *Eau Claire, Wis.*, 15th, river at this point highest ever known, water rose 24 feet in 48 hours. The loss to lumbering interests, by the carrying away of logs, will reach one and one half millions of dollars. Mill dams and bridges all along the river were swept away. At Menomonee, Wis., the Red Cedar river rose very rapidly, causing a loss to the Cedar Falls Manufacturing Company of ten million feet of logs and their dam. At Brainerd and Fort Ripley, Crow Wing and Morrison counties, Minn., 15th, railroad and highway bridges washed away; railway tracks badly washed out and many farms near Brainerd entirely under water. *Chippewa Falls, Wis.*, 15th, both bridges at the city were swept away and all on Duncan creek except one. Many houses in lower portion of city flooded, several million feet of logs carried away, loss one million dollars. *Waupaca county, Wis.*, 15th, great damage to building and crops along Pigeon and Embarrass rivers. The entire grain crops throughout Embarrass valley destroyed. *Clinton, Ia.*, 23rd to 25th, large portion of the town flooded, all saw-mills, paper-mills and sash factories closed. All railway tracks under water and warehouses approached by boat. All the islands in the vicinity were flooded and gardens, crops and other property destroyed; loss \$30,000. *Warsaw, Ill.*, 23rd to 25th, all lumber yards submerged and mills filled to the depth of from 2 to 6 feet. Several serious breaks were made in levee below the city. The principal highway to the city was covered with four feet of water and 20,000 acres of fine farming lands eleven miles below were inundated. Thousands of acres on the Missouri side in the same condition, causing great loss to farmers. *Dubuque, Ia.*, 23rd and 24th, river 22 feet 8 inches above low water mark and 14 inches above high water of 1870; such a body of water surpasses the memory of the oldest inhabitants. All railroad communication ceased and all machine shops and saw mills flooded and work suspended. A ferry boat was employed to transfer passengers to and from one of the hotels. All warehouses along the river were flooded and large quantities of merchandise carried away. *Prairie du Chien, Wis.*, 23rd to 25th, river higher than ever known before. One third of the city covered with water to the depth of 6 to 8 feet. All railroad communication interrupted, about 50 miles of track were submerged and several bridges carried away. *Davenport, Ia.*, 26th, river 18 feet 5 inches above low water mark, the highest since 1870. The city cemetery was overflowed and a number of coffins washed out. Several large mills compelled to stop work. Below the city many cultivated fields entirely submerged. *Rock Island, Ill.*, 26th, river 17.5 feet above low water mark; large portion of the city under water; west of 9th street a large number of houses floated about from their foundations, 200 families were driven from their houses. All the western portion of the city appeared like a lake dotted with roofs of houses. The Rock Island car shops were surrounded by water and the employés were carried to and from their work in row boats. The loss to private property alone is estimated at over \$100,000. *Burlington, Ia.*, 26th, all the bottom lands opposite the city flooded, causing vast damage to growing crops; river over eight miles wide. A vast area of fine farming country between Burlington and Iowa river completely submerged; crops almost a total loss. On the Illinois shore the water extended nearly four miles into the interior covering the entire tract of the bottom lands; loss to agricultural interests very great. *Montrose, Mo.*, bottom lands above the town completely inundated, causing great damage to crops. *Keokuk*, 29th, river 18 feet 2 inches above high water mark. All railroad communication interrupted; railroad shops completely surrounded with water. *Alexandria, Ia.*, 23rd to 25th, highest water since the great flood of 1876. Southern part of the city partly submerged and the bottom land in that vicinity covered with water, causing great damage to growing crops. A large quantity of wood was swept away from Watson's island, which was entirely covered with water. On June 30th, at 3 a. m., the Sny levee, below Quincy, Ill., broke between East Hannibal and Cincinnati landing. The crevasse during the day obtained a width of half a mile. Fully two hundred thousand acres of the finest farming land, all un-

der cultivation, was flooded. The levee protected a piece of country forty miles long by from four to ten miles wide. Three persons were drowned. Much stock was lost and great damage done to corn and hay, the wheat having generally been harvested. Estimated loss over one hundred thousand dollars. *Oregon and Washington Territory*, 27th to 30th, lower part of Portland, Oregon, flooded; many streets and stores flooded; much damage to growing crops in lower Columbia and Willamette valleys. 30th, the bottoms between Clackamas river and Oregon City overflowed, doing much damage. Sauvies Island and Columbia slough and all farms on west bank of Willamette river completely submerged. The town of Freeport, W. T. and all surrounding flat country under water, driving residents to the hills for safety. The whole country around Monticello, W. T., submerged, doing much damage to growing crops. 28th to 30th, three miles of railway, between The Dalles and Celilo, under water. 29th, unprecedented flood in Cowlitz's river, W. T., water three feet higher than ever before known. At railroad bridge, twenty miles above its mouth, river sixteen and a-half feet above low water. Northern Pacific railway, between Kalama and Cowlitz, under water for a distance of fifteen miles. Lewiston, Idaho, 27th, Snake river four inches above extreme high water of 1876. 30th, Wallula, W. T., river at a stand, one foot and eleven inches below high water of 1876. Skagit river, W. T., (no date given) higher than ever before known. The dike on the river broke, doing great damage to crops. June 30th, at Portland, Or., river reached twenty-seven feet four inches, (within one inch of high water of 1876,) overflowing Front and First streets, doing many thousand dollars worth of damage. The Dalles, Or., 26th, to 28th, all of Front street under water, flooding the principal hotels and stores of the city. 28th, river above high water of 1871 and near that of 1876; greater part of railway track under water; loss and damage by flood very great.

Droughts.—*New Jersey*, exceedingly severe in Bergen, Passaic and Essex Counties. 30th, Hackensack and Mount Claire, water for domestic purposes very scarce. Atco, very dry, crops much injured, wells failing. Somerville, drought for past two months, very injurious to hay. Freehold, very dry, crops suffering. *New Hampshire*, 13th to 20th, Auburn, very severe. *New York*, 30th, Hector, drought very severe. White Plains, "drought commenced on last day of April and has continued to July 1st, during which time (62 days,) only 1.43 inches of rain fell; all vegetation is suffering severely." *Georgia*, 23rd, Augusta, very severe, injuring gardens and crops. *Kansas*, 15th, Creswell, small streams nearly all dry. *Maryland*, 29th, Sandy Springs, wheat crop very poor, owing to severe drought. *Massachusetts*, 26th, Springfield, vegetation suffering. Connecticut river very low, only 13 inches above low water.

Rain-fall During May, Received too late to be used in May Review.—*Arizona*: Whipple Barracks, Ft. Lowell, Ft. Bowie, Ft. McDowell, Ft. Verde, Ft. Apache and Ft. Mojave, 0.00; Wickenburg, 0.17. *California*: Benicia Barracks, 0.84; Angel Island, 1.14; Alcatraz, 0.95; Presidio, S. F., 0.88; Ft. Yuma, 0.00; Ft. Gaston, 3.48; Ft. Bidwell, 1.38. *Colorado*: Ft. Lyons, 1.09. *Dakota*: Ft. Randall, 6.21; Ft. Stevenson, 3.29; Ft. Sisseton, 3.50; Ft. Sully, 1.88; Ft. Totten, 4.38; Ft. Hale, 3.68. *Idaho*: Ft. Lapwai, 2.40. *Montana*: Ft. Benton, 1.54; Ft. Shaw, 2.36; Ft. Ellis, 7.13; Ft. Logan, 2.58; Ft. Assiniboine, 0.79. *Nebraska*: Camp Sheridan, 1.60. *Nevada*: Ft. McDermitt, 0.39; *Oregon*: Ft. Stevens, 4.91; Ft. Klamath, 1.24; Ft. Harney, 0.72. *Texas*: Rio Grande City, 1.64; Brownsville, 1.56. *Washington Ty.*: Ft. Canby, 5.22; Ft. Townsend, 2.20; Neah Bay, 6.62; Bainbridge Island, 3.20. *Wyoming*: Ft. Fred. Steele, 0.78.

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, from 62 to 86; Middle Atlantic States, 57 to 87; South Atlantic States, 57 to 80; Eastern Gulf States, 65 to 77; Western Gulf States, 68 to 73; Ohio valley and Tennessee, 61 to 72; Lower Lake region, 63 to 73; Upper Lake region, 68 to 81; Upper Mississippi valley, 63 to 69; Missouri valley, 62 to 69; Red River of the North valley, 75; Eastern Rocky Mountain Slope, 20 to 68; Rio Grande valley, 49 to 74; Plateau districts, 17 to 43; California, 36 to 76; Oregon, 39 to 63. *High stations* report the following averages not corrected for altitude: Pike's Peak, 48.2; Mt. Washington, 82.3 per cent.

WINDS.

The prevailing direction of the wind during the month of June, 1880, is shown, by arrows flying with the wind, on chart No. II. The prevailing direction along the entire Atlantic slope and in the Lake region was southwest; in the great central valleys south; in Texas southeast. To the westward of 102° W. the prevailing direction was northerly to the northward of the parallel 40°, and southwesterly to the southward of that parallel. The prevailing directions on Mt. Washington NW., and Pike's Peak SW., were normal.

The maximum velocities per hour are generally given in the description of the areas of low pressure. The following are the maximum velocities exceeding 50 miles per hour that have been reported during June, 1880: Madison, Wis., 50 S.; St. Louis, 52 S.; Dodge City, 52 NW.; Kittyhawk, 52 NE.; Delaware Breakwater, 54 NW.; Breckenridge, 56 NE.; Portsmouth, N. C., 56 NW.; Omaha, 60 NW.; North Platte, 62 N.; Cape Henry, 64 NW.; Mt. Washington, 70 NW., and Pike's Peak, 72 SW.

Total Movements of the Air.—The following are among the largest total movements in the various districts: Pike's Peak, 12,978; Cape Lookout, 12,940; North Platte, 12,580; Fort Stockton, 10,581; Delaware Breakwater, 9,643; Umatilla, 9,136; San Francisco, 9,098; Indianola, 8,453; Sandusky, 8,363; Milwau-

kee, 8,199; Bismarck, 7,932; Wood's Holl, 7,392; St. Louis, 7,113; Cedar Keys, 6,875; Cairo, 5,874. The record on Mt. Washington is incomplete owing to the frost work. The *smallest* are: Atlanta, 1,669; La Messilla, 1,743; Lynchburg, 2,364; Roseburg, 2,486; Deadwod, 2,971; Springfield, Mass., 3,021; Los Angeles, 3,185; Nashville, 3,270; Little Rock, 3,958; Duluth, 4,356; Oswego, 4,368.

Local Storms.—The following account of the tornado at Savoy, Fannin Co., Tex., was received too late for the May REVIEW: About 10 p. m., May 28th, 1880, two large black clouds (one moving from SE. and the other from the NW.) met SW. of the town and formed one funnel-shaped cloud, causing a low rumbling sound to be heard. During the formation, vivid electrical discharges in the shape of large balls of fire, occurred. Pendent from the cloud was a long cylinder which rotated from W. to E. by the south point, and touched the earth continuously during its passage through the town. The track was about 180 yards wide, direction SW. to NE., duration about two minutes. No wind was felt outside the path. The tornado left the earth N. of the town and was not again heard of. Its passage was marked by hail and followed by heavy rain, which continued several hours. Twelve persons were killed and over sixty wounded; some fatally. Every house in the track, 48 in number, was destroyed. The surrounding country is a rolling prairie with no native timber. St. Louis, Mo., June 4th, strong S. wind attaining, at 11 a. m., velocity of 52 miles. The storm was accompanied by thunder, lightning and heavy rain. One person was killed and several injured. Several buildings were unroofed and much damage done to others. Considerable damage was also done south of the city. Pottawattamie Co., Iowa, 10th, during p. m., terrible tornado swept through the southeastern portion of the county, destroying everything in its path, which averaged about a half mile in width. Wind clouds, of very portentous appearance, were first observed forming both in the east and west. In a short time they came together and formed a conical-shaped cloud, which rapidly extended downward to the earth, when the work of devastation commenced. At one place, a farmer's house, surrounded by a frail fence, was carried out of the yard and dashed to pieces, leaving every board of the fence remaining in its place. Twenty persons were killed outright and all buildings literally torn to pieces. The passage of the storm was almost instantaneous; no rain accompanied it. Brownsville, Mower Co., Minn., 11th, very violent wind storm causing great destruction to buildings and fences; one person killed. Sparta, Monroe Co., Wis., 11th, round house of the Chicago and Northwestern railroad blown down and several other buildings demolished. Glendale, Ohio, 14th, 8 p. m., violent wind and rain-storm, passed through the village from SW. to NE. Scarcely a dwelling remained uninjured; scores of the largest trees either uprooted or twisted off near the ground. Many of the largest buildings were torn to pieces and heavy objects carried long distances. Loss to buildings estimated at \$80,000. Near Springdale, the damage was proportionately severe, 15 buildings were either badly injured or completely destroyed and several animals killed. At Evendale six buildings were wrecked and five animals killed. In the vicinity of Montgomery, several buildings destroyed, and scores of trees uprooted or twisted off. At Venice and Symmes Corner, Butler Co., the destruction was particularly severe, acres of timber were shorn of their branches, fields of grain in the shock were scattered in every direction, large orchards were completely destroyed, dwellings and out-buildings were either unroofed or entirely blown down. Between 50 and 60 buildings were badly injured or destroyed and several animals killed. The heavy iron bridge, 113 feet long, spanning Indian Creek, was whirled from its abutments. Two other heavy bridges in the vicinity were similarly destroyed. Numerous chickens and turkeys were found dead in the path of the storm, with the feathers completely stripped from their bodies. The noise accompanying the storm was described as terrible, resembling the report of a large cannon in its reverberations. In Morgan township the storm was very severe, buildings, fences and trees were damaged to the extent of about \$20,000. At Miami, the storm left the town in ruins. The large covered bridge over the Little Miami river was swept away. Riverside, Del., 12 p. m., violent wind storm causing great damage to peach orchards, several buildings demolished. At Middletown, Del., the roof of the National Hotel was lifted and carried half a mile; many other buildings badly wrecked, and several peach orchards entirely destroyed. Shelbyville, Ind., 14th, p. m., very violent tornado, many buildings destroyed and great damage done to farm property, one person killed. The storm moved from SW. to NE.; path very narrow. New York City, 14th p. m., very heavy wind storm, many buildings unroofed and otherwise injured; storm continued for about fifteen minutes. At Paterson and Newark, N. J., buildings were damaged to the extent of \$25,000.

Waterspouts.—Cape Henry, 12th, 6 p. m., three distinct waterspouts were observed at sea 200 yards from station, moving southeastward with extreme rapidity, disappearing when about two miles below station. The spiral motion in each spout was from left to right. Ft. Barrancas, Fla., 2nd, 10:10 to 10:50 a. m., four miles from shore moving slowly southeastward.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for June, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 88.7 per cent. The percentages for the four elements are: Weather, 87.7; Direction of the Wind, 88.5; Temperature, 88.6; Barometer, 90.0 per cent. By geographical districts they are: for New England, 86.6; Middle States, 87.1; South Atlantic States, 92.5; Eastern Gulf States, 91.9; Western Gulf States, 92.6; Lower Lake region, 89.9; Upper Lake region, 86.0; Tennessee and the Ohio valley, 90.4; Upper Mississippi valley, 85.2; Lower Missouri valley, 83.4; Northern Pacific coast region, 77.0; Central Pacific coast region,

100.0; Southern Pacific coast region, 100.0. There were 12 omissions to predict out of 3,690, or 0.33 per cent. Of the 3,678 predictions that have been made, 82, or 2.23 per cent, are considered to have entirely failed; 99, or 2.69 per cent, were one-fourth verified; 348, or 9.46 per cent, were one-half verified; 345, or 9.38 per cent, were three-fourths verified; 2,804, or 76.24 per cent, were fully verified, so far as can be ascertained from the tri-daily reports.

Cautionary Signals.—89 Cautionary Signals were displayed during the month, of which 76, or 85.4 per cent, were justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of the station. 12 Off-shore Signals were displayed, of which 88, or 66.7 per cent, were fully justified; 9, or 75.0 per cent as to direction; 10 or 83.3 per cent, as to velocity. 101 signals of both kinds were displayed, of which 84 or 83.2 per cent, were fully justified. The above does not include signals ordered for 50 display stations, where the velocity is only estimated. 117 cases of winds of 25 miles and over per hour, from scattered stations, were reported, and for which signals had not been ordered. 11 signals were ordered late.

NAVIGATION.

In the table on the right hand side of chart No. III. the highest and lowest stages of water, as recorded on the river gauges, occurring during the month of *June*, 1880, at Signal Service stations, are given, with the dates of the same. The following is a general resumé of the condition of the rivers during the month. The *Red River* at Shreveport rose slowly from 9 ft. on the 1st to 17 ft. on the 20th, and fell to 14½ ft. by the 30th. The *Arkansas* at Little Rock remained very low and almost stationary throughout the month. The *Missouri* at Yankton rose from 6 ft. on the 1st to 10 ft. on the 5th, but fell to about 4½ ft. by the 10th; on the 13th a second rise set in which continued to end of month, when the water reached 12 ft.; at Omaha it rose from 9 ft. on the 1st to 12 ft. on the 6th; fell slowly to 10½ ft. by the 13th, and afterward rose to 16 ft. 2 in. (or 2 inches above danger-line) by the 30th; at Leavenworth it rose from about 8½ ft. from 1st to 3rd, to 12 ft. on the 7th; fell to 10½ ft. on the 13th, rose to 14 ft. by the 22nd, and remained almost stationary to end. The *Mississippi* at St. Paul rose from 7 ft. on the 1st to 15 ft. 3 in. on the 17th, passing the danger-line, 14½ ft., on the 15th; from the 17th it fell slowly to 9 ft. on the 30th. At La Crosse it remained almost stationary, about 5 ft., until the 5th, when the rise set in; by the 19th the water had reached 15 ft. 2 in., after which it fell to 9 ft. 5 in. by the 30th. At Dubuque it remained almost stationary, about 9½ ft., until the 7th, when it commenced to rise slowly, and, passing the danger-line, 21 ft. 10 in., on the 21st, reached 22 ft. 8 in. on the 23rd, after which it fell to 18½ ft. by the 30th. At Davenport it remained almost stationary, about 8 ft., until the 15th, when the rise set in, and, passing the danger-line, 15 ft., on the 19th, reached 18 ft. 5 in. on the 26th. Major D. W. Flagler, U. S. Army, at Rock Island Arsenal, gives the highest water (*above low water of 1863*) at Rock Island bridge 17.15 ft. on the 26th and at Moline bridge 22.75 ft. on the 25th and 26th. He says, "This is the highest water of which there is any certain record along this portion of the Mississippi river, and it is certainly the highest water that has occurred since 1851. According to the best evidence I can obtain this high water was along the Rock Island rapids generally 1.08 feet higher than the high water of 1870." At Keokuk it remained almost stationary, about 9½ ft., until the 17th, when the rise set in, and, passing the danger-line, 14½ ft., on the 22nd, reached 18 ft. 2 in., on the 29th. At St. Louis, Cairo and Memphis it remained almost stationary throughout the month, rising slowly towards the end. At Vicksburg and New Orleans it changed but little throughout the month. The *Ohio*, at Pittsburg, remained low and almost stationary until the 13th; on the 14th, 15th and 16th, it rapidly rose to 15 ft. 11 in., after which it fell to end. At Cincinnati it remained almost stationary until the 14th, when it commenced rising and reached 24 ft. 6 in. on the 20th. At Louisville it changed but little throughout. The *Tennessee*, at Chattanooga, the *Cumberland*, at Nashville, and the *Savannah*, at Augusta, changed but little during the month. The high water in the Upper Mississippi during the latter half of the month resulted in immense damage to property along the banks, which will be found in detail under the head of *Floods*.

Icebergs.—In view of the remarkable number of icebergs and extensive fields of ice which have been reported off the banks of Newfoundland, the following table has been compiled from such marine reports as have fallen under the notice of this office. The quantity of ice reported has been greater than that of any year since 1875. In this connection, the following meteorological notes are of interest: *Maritime Register*, June 9th.—"The past winter in southern Greenland has been very severe and the spring very stormy." *London Times*, June—. The winter of 1879-80 in Iceland, very mild, pressure low; early and enormous discharges of polar icefields and icebergs since March, 1880. Large iceberg reported by steamer *Nederland*, June 21st in 40° 12' N., 44° 18' W., is probably one of the most southerly ever reported in that longitude.

YEAR 1880.	Extreme limits of ice field.						Total number estimated as per schedule.	Dimensions of large bergs.			
	East side.		South side.		West side.			Height.		Length.	
								Extreme.	Mean.	Extreme.	Mean.
	MONTH.	Date.	W. long.	Date.	N. lat.	Date.		W. long.	Number.	Feet.	Feet.
February.....	20	47° 00'	23	44° 00'	25	49° 10'	25	300	125	500	240
March.....	16	46° 00'	22	42° 30'	24	49° 36'	153	130	67		
April.....	30	45° 36'	27	42° 50'		50° 00'	87	300			
May.....	18	45° 16'	21	40° 35'	31	54° 00'	779	300	130	15,840	2,800
June.....	2	44° 00'	21	40° 12'	21	55° 25'	491	600	215	2,640	1,300

Contrary to the popular opinion in this respect, these enormous fields of ice do not lower the temperature of the Atlantic Slope, which in its entire extent, from the Canadian Maritime Provinces to Florida, has experienced during May and June, mean temperatures decidedly above the normal.

High Tides.—Galveston, Tex., 12th, large portion of east part of island submerged. Cape Lookout, N. C., 16th, 17th. Ft. Macon, N. C., 18th. Portsmouth, N. C., 15th to 17th.

TEMPERATURE OF WATER.

The temperature of water as observed in rivers and harbors at Signal Service stations, with average depth at which observations were taken, is given in the table on the left hand side of chart No. II. At the following stations, the thermometers being broken, prevented observations on the dates given: Chicago, 11th to 17th; Duluth, 6th to 16th; Savannah, 2nd to 25th. The report from Punta Rasa has not been received.

ATMOSPHERIC ELECTRICITY.

Thunder-storms.—New England, 1st, 2d, 6th, 7th, 11th, 12th, 13th, 14th, 16th, 17th, 21st to 30th. Middle Atlantic States, 1st to 3d, 6th to 14th, 16th, 17th, 21st to 30th. South Atlantic States, 1st, 2d, 3d, 6th, 7th, 8th, 9th, 11th to 16th, 25th, 30th. Lower Lake region, 6th, 9th to 14th, 25th to 30th. Upper Lake region, 1st to 6th, 9th to 15th, 18th, 19th, 23d to 30th. East Gulf States, 1st to 15th, 19th to 30th. West Gulf States, 1st, 2d, 5th, 6th, 9th to 16th, 20th to 30th. Ohio valley and Tennessee 2d, 6th, 11th to 14th, 19th to 30th. Upper Mississippi and Lower Missouri valleys, 1st to 30th. Eastern Rocky Mountain slope, 4th, 12th, 17th, 18th, 20th to 25th, 29th, 30th. Arizona, 19th, 20th. Oregon, 10th. Washington Territory, 7th.

Auroras.—On the 12th the aurora was observed in New Hampshire and Wisconsin, and at Vevay, Ind. Cloudy weather in the Lower Lake region probably prevented observations in that section. On Mt. Washington, at 8 p. m., faint; color, pale straw. Milwaukee, from 8 to 9 p. m., faint; color, pale blue, changing to indistinct orange; altitude about 10°; no motion. Vevay, Ind., until 1:30 a. m. of the 13th; altitude about 45°; faint flashes of white light, alternating with faint pulsations of crimson color. On the 15th auroral displays occurred from Maine to Dakota. Gardiner, Me., not visible at 9, but quite bright from 11 p. m. to 1 a. m. At Montreal, Can., auroral display. Burlington, Vt., faint, with distinct dark segment, from 11:15 p. m. to 12:15 a. m. of the 16th. Milwaukee, from 8 to 9 p. m., from N. to W.; faint; altitude about 5°; color well defined blue, shading into orange at the horizon; motionless, except slight tremor in blue light. Escanaba, 9 p. m. to 10:15 p. m.; arch of pale yellow, extending from 45° to 60° azimuth; altitude about 20°. Pembina, 9 p. m., faint, but indistinct, owing to bright moonlight. 16th, displays reported from Vermont to Iowa. Burlington, Vt., from midnight to 12:30 a. m. of the 17th; faint, no definite characteristics. Escanaba, 8:45 p. m., of increasing brilliancy till 9:30 p. m., then gradually fading away; disappeared at 11 p. m.; well defined beams of 2° breadth, reaching an altitude of 45°; color, pale yellow. Thornville, Mich., from 9:30 to 10 p. m., faint; slight movement of rays from E. to W. Monticello, Ia., display at 11 p. m. Isolated cases of displays occurred as follows: Gardiner, Me., 18th, from 1 a. m. to 2:30 a. m.; extent, 45° from N. to NE., resembling the light of the rising moon. Burlington, Vt., 14th, faint from 11:15 p. m. till after midnight; bright arch of light. Burlington, Vt., 27th, from 12 to 12:25 a. m., bright arch, with distinct dark segment, but no streamers. Milwaukee, 11th, 8 to 10 p. m., faint; extending from N. to W.; color, pale blue, shading to indistinct orange at horizon; interspersed with dark hazy streaks, seemingly arising from nucleus of dark segment; no perceptible motion. Pembina, 14th, 9:40 p. m., to morning of 15th, extent from 180° to 255° azimuth; altitude, 15°. One narrow arch, lower edge well-defined, but upper irregular and broken, with motion as of faint phosphorescent flames, rising from a ribbon of half-smothered fire; marked intermittence of brilliancy. Occasionally quick luminous rays shot towards the zenith, with the tremulous motion characteristic of "merry dancers." The peculiarity of the display was the color of the arch, which was uniformly green, varying in shade, but at no time displaying any other variety of color. Independence, Iowa, 5th, auroral display. St. Meinrad, Ind., 3d, 8 to 9 p. m., in NW., faint, extent, 35°, altitude, 20°; 10th, 9 p. m., faint on account of bright moonlight; 11th, 9 to 11 p. m., extent, 120°, altitude, 30°, diffuse arch of yellowish white. Bellefontaine, Ohio, 26th, 9 p. m., seen through rift in clouds. The most southerly station reporting during the month was St. Meinrad, Ind.

OPTICAL PHENOMENA.

Solar and Lunar Halos were not very numerous during the month, but were most frequently observed along the Atlantic coast, in Tennessee and the Ohio valley and in Oregon.

Mirage.—New London, Conn., 12th, nearly all day and from 8 to 8:30 p. m.

MISCELLANEOUS PHENOMENA.

Earthquakes.—San Francisco, Cal., 24th, 12:47 a. m.

Prairie and Forest Fires.—Pike's Peak, 4th, 7th, 8th, 11th, 14th, 16th, 19th; Santa Fe, 8th to 14th; Colorado Springs, 9th.

Locusts.—30th, Hudson, Mich., very numerous one mile west of this place. Umatilla, Or., very nume-

rous; much damage to gardens; 25th, still very destructive. 5th, Umatilla, Oregon, very numerous in county, doing much injury to gardens. 25th, still very destructive. Fort Sill, I. T., 10th, large numbers of young grasshoppers. Reno, Nev., June 18th, have done considerable damage to growing grain; hatching out in myriads; north end of Sierra Valley already stripped of every green thing, but at south end, the insects are just hatching out. Fort Gibson, I. T., 29th, flying west. Winnemucca, Nev., 30th, very large numbers of young grasshoppers in Paradise Valley.

Sunsets.—The characteristics of the sky at sunset as indicative of fair or foul weather for the succeeding twenty-four hours have been observed at all Signal Service Stations. Reports from 144 stations show 4,255 observations to have been made, of which 21 were reported doubtful; of the remainder, 3,374 or 79.3 per cent. were followed by the expected weather.

Atmospheric Electricity.—*New Mexico*—Santa Fe, 4th, 16th to 20th, 24th. *Colorado*—Colorado Springs, 23d. *Texas*—Castroville, 1st, 6th, 25th, 29th; Laredo, 5th, 9th, 12th; Coleman City 15th; Concho, 5th, 15th, 27th, 29th; Stockton, 3d, 12th, 15th, 25th, 26th; Fort Davis, 6th, 11th, 12th, 15th, 25th, 26th, 29th; Fort McKavett, 16th; Fort Elliott, 15th.

Army Worm.—Freehold, N. J., 10th, ruining many fields of grass and grain. 17th, Whitehall and Nazareth, Pa., have destroyed large fields of grass and rye. 11th, at and near, Northport, and along the shores of Great South Bay, Long Island, doing great damage to crops. 11th, at Eatonville, and from Freehold to Mt. Pleasant, N. J., exceedingly destructive. Kent county, Del., early part of month, doing great damage to growing grain. 3rd, Hempstead and Islip, Long Island, doing great damage.

Meteors.—Macon, Ga., 30th, about midnight a brilliant meteor appeared near the zenith like a great mass of fire as large as a barrel and whirling in the air. It moved slowly down the northeastern sky and when at an elevation of 45° the light changed to a brilliant red, faded into saffron and then into all shades of green. At an elevation of 30° the light disappeared and at the expiration of about three minutes a terrible explosion followed. Light was sufficiently brilliant to awaken people in their houses. Was observed at Hawkinsville 40 miles south and at Eatonton 50 miles north. Little Rock, Ark., 14th, very bright, color, violet, course from E. to W., trail about 10° long; 22nd, 10:05 p. m., color, yellow; course from E. to W., trail 15° long. Mayport, Fla., 29th, 8:15 p. m., very brilliant meteor; color, yellowish white; course W. to E. Shreveport, 28th, 10 p. m., very large and brilliant; course from zenith to southern horizon; about midway to horizon exploded scattering pieces in all directions.

Zodiacal Light.—Yates county, Kan., 1st, 2nd, 5th, 6th, 8th, 9th. Nashville, Tenn., 10th, very bright. Mr. Charles Hasselbrink, Havana, Cuba, reports:—May 31st, 8:30 p. m., light bright and sensibly intermittent, but not rapid or sudden; 9:30 p. m., axis inclined to south about 45°, azimuthal extension (35 to 40 degrees) remarkable. June 1st, 8 p. m., light exceedingly bright, of a whitish blue tint; 8:25 p. m., inclined to south 65° and at 9 p. m., 45°, intermittence frequent and sensible; 7th, 8 to 10 p. m., very bright and extensive, intermittence very sensible, inclination of axis to the south 45°. Constant cloudiness from 2nd to 6th and 8th to 12th.

Sun Spots.—The following record of observations, made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent, Nautical Almanac Office, Washington, D. C.:

DATE— June, 1880.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		REMARKS.
	Groups	Spots.	Groups	Spots.	Groups	Spots.	Groups	Spots.	
3rd, 4 p. m...	0	1	0	20†	0	1	2	8	Faculae.
4th, 3 p. m...	0	0	0	2	0	0	2	6	Faculae.
8th, 4 p. m...	2	7	.....	.....	1	2	2	7	
11th, 4 p. m...	0	0	0	0	0	0	1	5	
16th, 4 p. m...	1	7	.....	.....	1	7	1	7	Spots probably disappeared by solar rotation.
17th, 3 p. m...	1	3	0	0	1	3	2	10	
18th, 4 p. m...	0	7†	0	0	0	0	2	17†	Faculae.
19th, 3 p. m...	1	0	0	0	0	0	3	23†	Faculae. Many of the spots small.
21st, 4 p. m...	0	0	1	1	0	0	2	22†	Many of the spots small.
22nd, 5 p. m...	0	12	0	0	0	0	2	34†	Many of the spots small.
23rd, 5 p. m...	0	0	0	4	0	0	2	30†	Many of the spots small.
28th, 5 p. m...	2	20†	1	15	.....	.....	3	35†	Faculae.
30th, 9 a. m...	0	0	1	15	0	0	2	30	Faculae.
30th, 5 p. m...	0	0	0	0	0	0	2	30	Faculae.

†Approximated.

Mr. Wm. Dawson, at Spiceland, Ind., reports: 1st, 2 groups, (low power and poor air;) 2nd, 2 groups, 53 spots; 3rd, 2 groups, 24 spots; 5th, 1 group, 2 spots; 7th, 1 group, 8 spots; 10th, 3 groups, 25 spots; 11th, 2 groups, 16 spots; 12th, 2 groups, 10 spots; 13th, 2 groups, 7 spots; 16th, 1 group, 7 spots and 2 groups, 12 spots; 17th, 2 groups, 26 spots; 18th, 2 groups, 54 spots; 19th, 3 groups, 62 spots; 20th, 3 groups, 85 spots; 24th and 25th, 3 groups, 80 spots; 27th, 2 groups, 45 spots; 28th, 3 groups, 28 spots; 29th, 5 groups, 26 spots. A large spot has just disappeared by solar rotation. Mr. H. D. Gowey, at North Lewisburg, Ohio, reports: 23rd, 8.45 a. m., group; 25th, 9.30 a. m., on SW. quarter near equator.

Mr. F. Hess, Fort Dodge, Iowa, reports: "1st to 13th, about 30 spots traversed the sun and disappeared by rotation. 9th, a new spot, among extensive faculae, appeared, which at 10 a. m. of the 11th had

disappeared. New groups of spots and faculae appeared on the 14th and 17th and remained visible to end of month—most numerous on the 25th when 38 spots were visible."

Mr. David Trowbridge, at Waterburg, N. Y., reports: 22nd, group visible without a telescope.

EXTRACTS.

(From *Nature*, June 17, 1880.)

A Meteorological Conference was held at Sydney in November last, the representatives of the different Colonies being Messrs. James Hector for New Zealand, Charles Todd for South Australia, R. L. J. Ellery for Victoria, and H. C. Russell for New South Wales. The whole question of weather telegrams was under anxious consideration. The system in present operation embraces only the Colonies of South Australia, Victoria, New South Wales, and Queensland, but a resolution was passed declaring it desirable to secure the co-operation of the Governments of Western Australia, Tasmania, and New Zealand in the system of inter-colonial weather telegrams. The facts pointed out by Mr. Todd as to the great regularity observed by the atmospheric disturbances in pursuing a course from west to east, and the statement by Dr. Hector that early notices could be sent from Queensland of the origin and progress of the dangerous and suddenly occurring cyclones that cross the northern part of New Zealand, sufficiently attest the practicability of the system of weather warnings and their practical value. For instance, the great storm which wrecked the *Dandenong* in September, 1876, could have been telegraphed in sufficient time to have prevented the great loss of property which took place at the different ports along the coast of New South Wales. We have the greatest pleasure in noting a deliverance by the Conference to the effect that weather telegrams and forecasts shall in all cases depend upon the observations used for general meteorological and climatological statistics. Much emphasis was laid on the establishment of high-level stations with a more special view to the investigation of the winds; and the Conference recommended that there be established in each of the Colonies, upon a high mountain peak, a meteorological observatory for the special study of winds and other meteorological phenomena.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

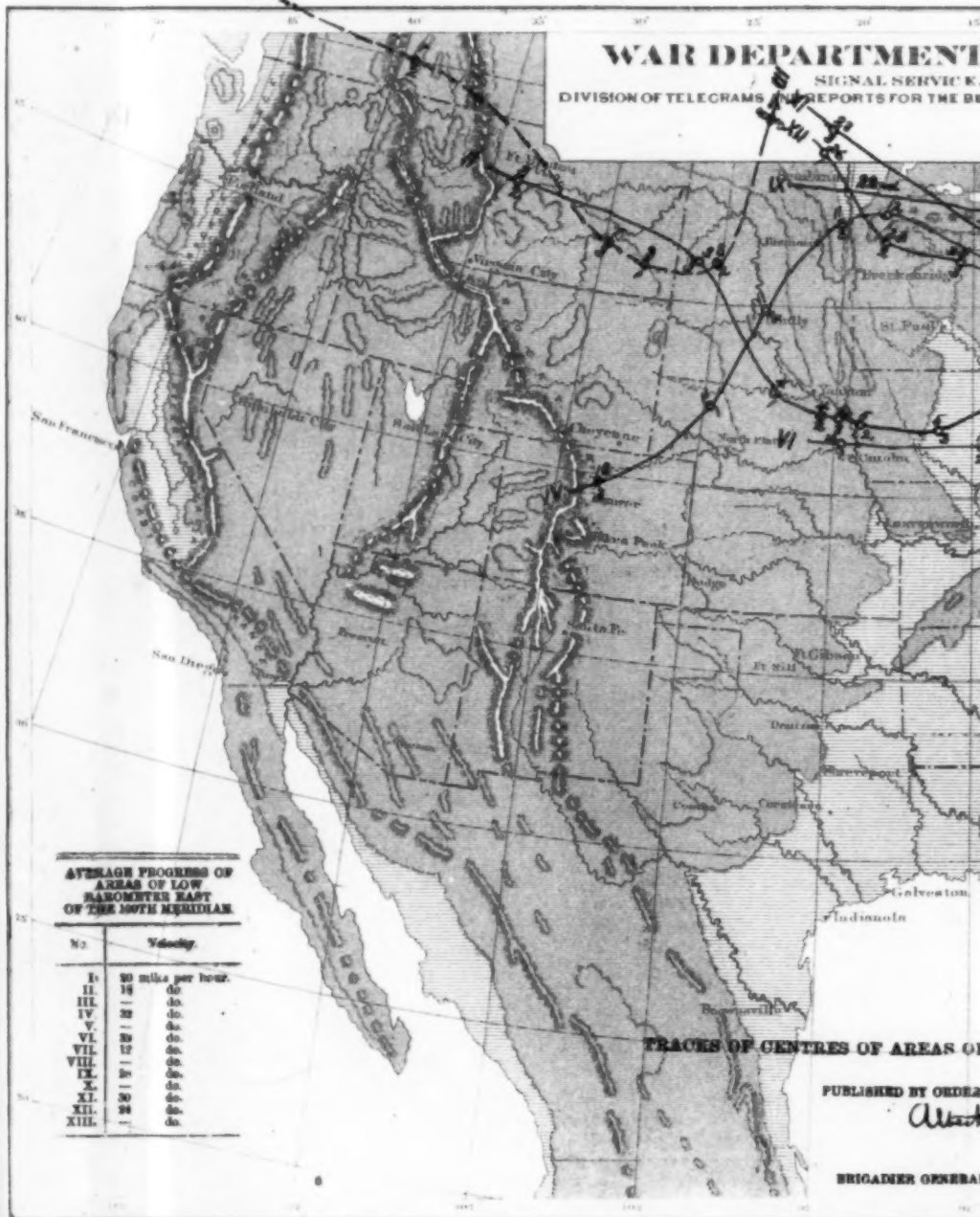
Albert J. Myer

Brigadier General, Chief Signal Officer, U. S. A.

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WAR DEPARTMENT
SIGNAL SERVICE
DIVISION OF TELEGRAMS AND REPORTS FOR THE DEPARTMENT



**AVERAGE PROGRESS OF
AREAS OF LOW
BAROMETER EAST
OF THE 100TH MERIDIAN**

No.	Velocity
I.	40 miles per hour.
II.	18 do.
III.	— do.
IV.	22 do.
V.	— do.
VI.	23 do.
VII.	17 do.
VIII.	— do.
IX.	— do.
XI.	30 do.
XII.	24 do.
XIII.	— do.

TRACKS OF CENTRES OF AREAS OF

PUBLISHED BY ORDER

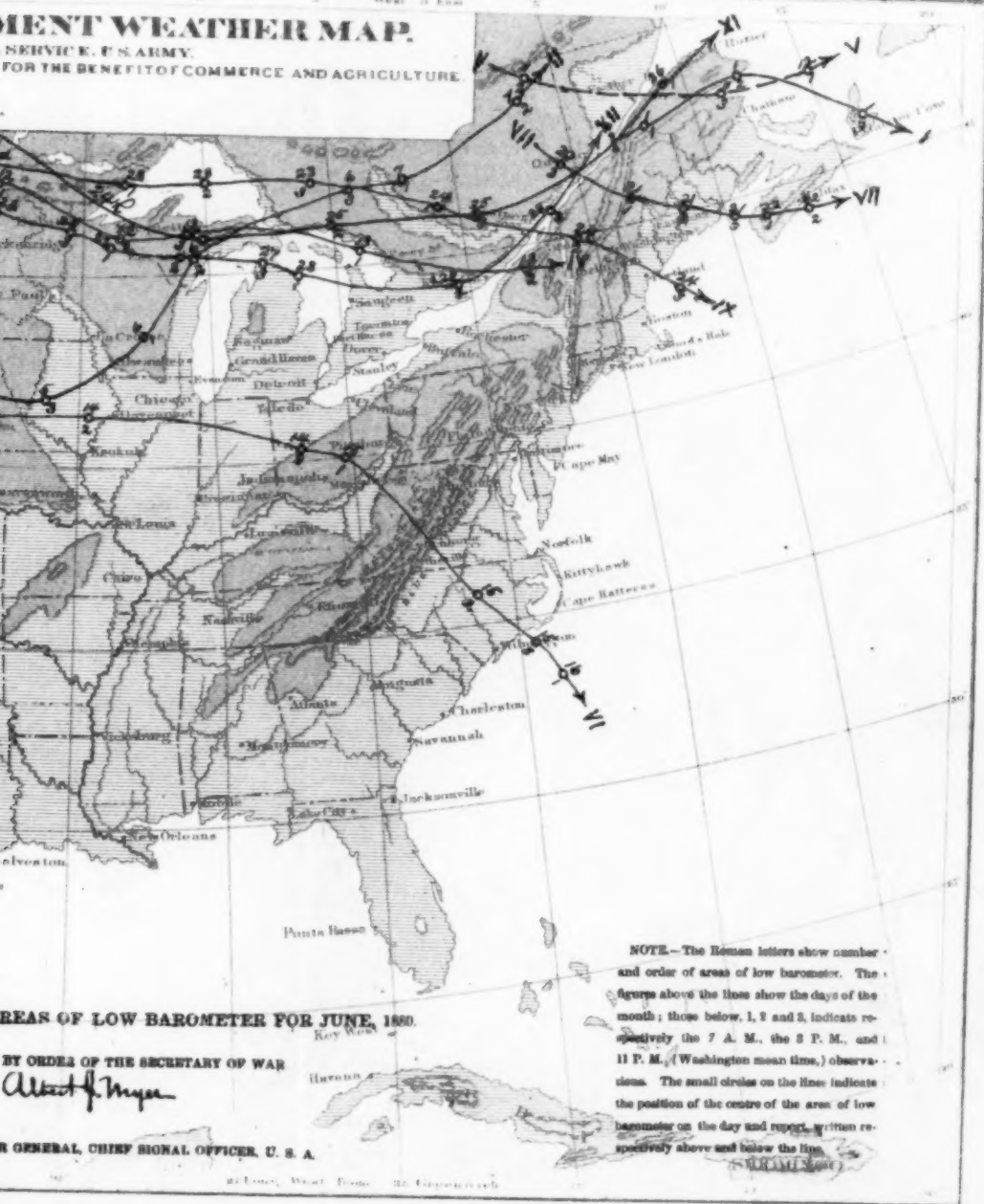
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BRIGADIER GENERAL

No. 1.

WENT WEATHER MAP.

SERVICE, U. S. ARMY.
FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.



REAS OF LOW BAROMETER FOR JUNE, 1890.

BY ORDER OF THE SECRETARY OF WAR

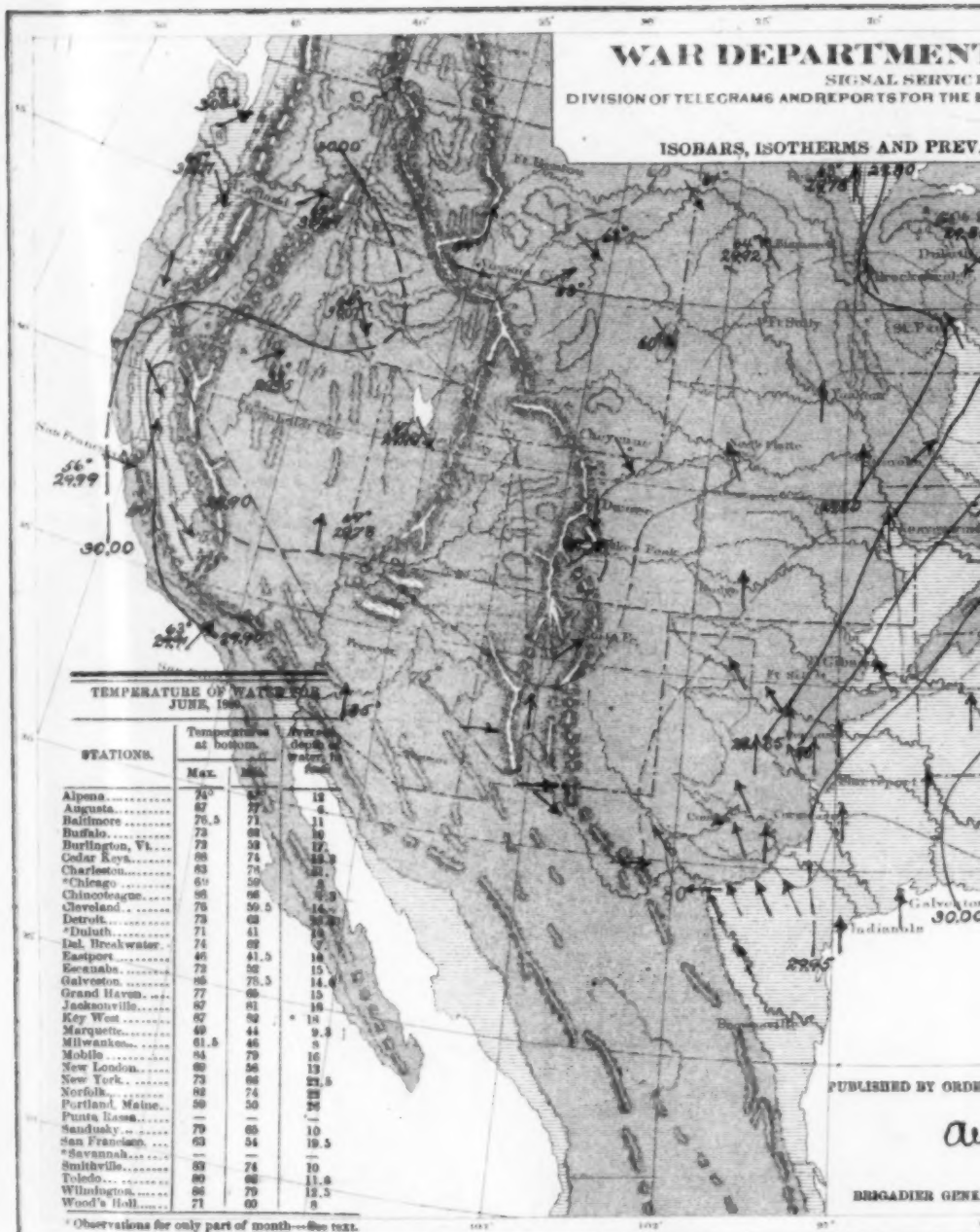
Albert J. Myer

GENERAL, CHIEF SIGNAL OFFICER, U. S. A.

NOTE.—The Roman letters show number and order of areas of low barometer. The groups above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7 A. M., the 3 P. M., and 11 P. M. (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report written respectively above and below the line.

WAR DEPARTMENT
SIGNAL SERVICE
DIVISION OF TELEGRAMS AND REPORTS FOR THE

ISOBARS, ISOTHERMS AND PREV.



* Observations for only part of month—See text.

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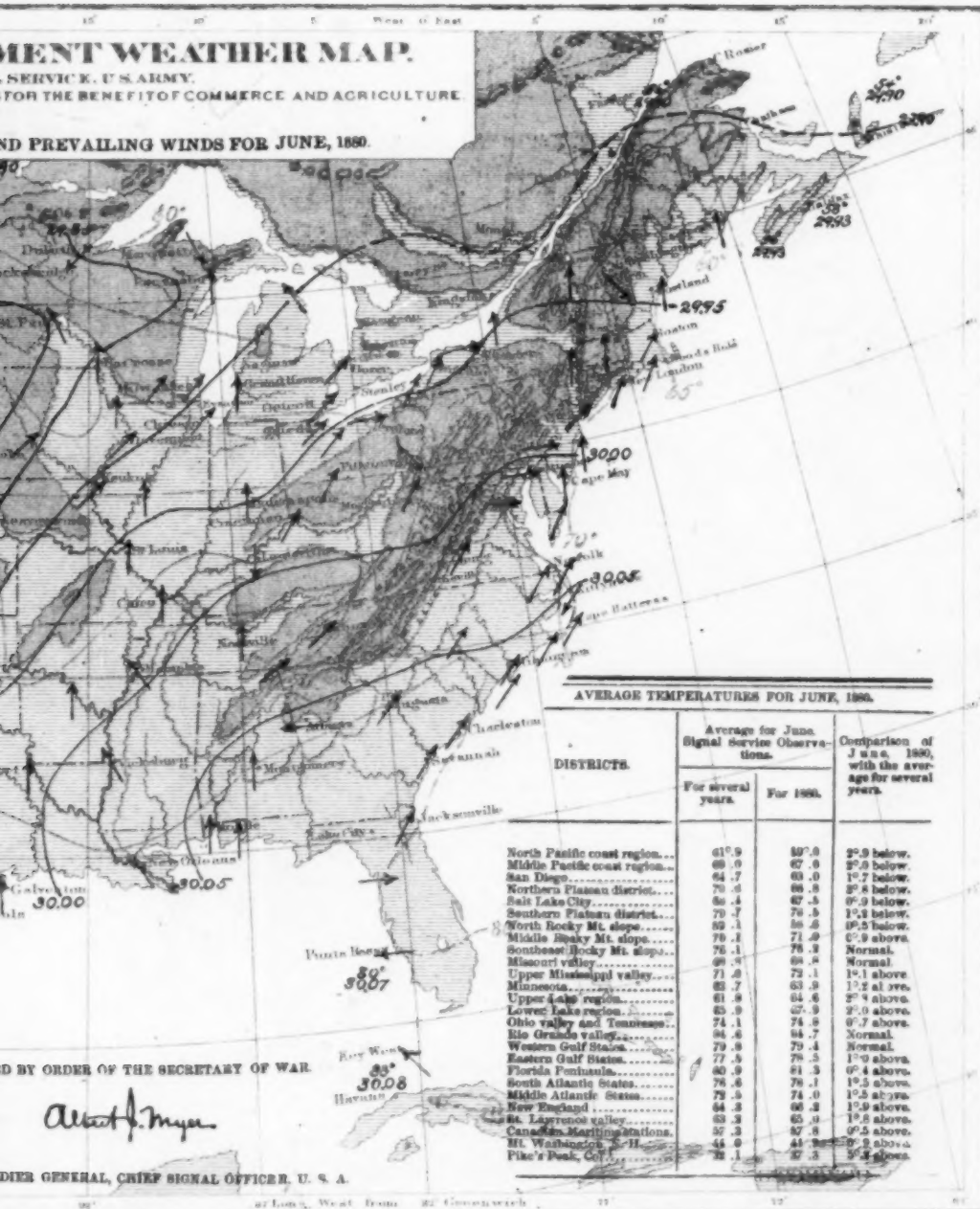
at

BREAGDIER GENL

MENT WEATHER MAP.

SERVICE, U. S. ARMY.
FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

AND PREVAILING WINDS FOR JUNE, 1880.



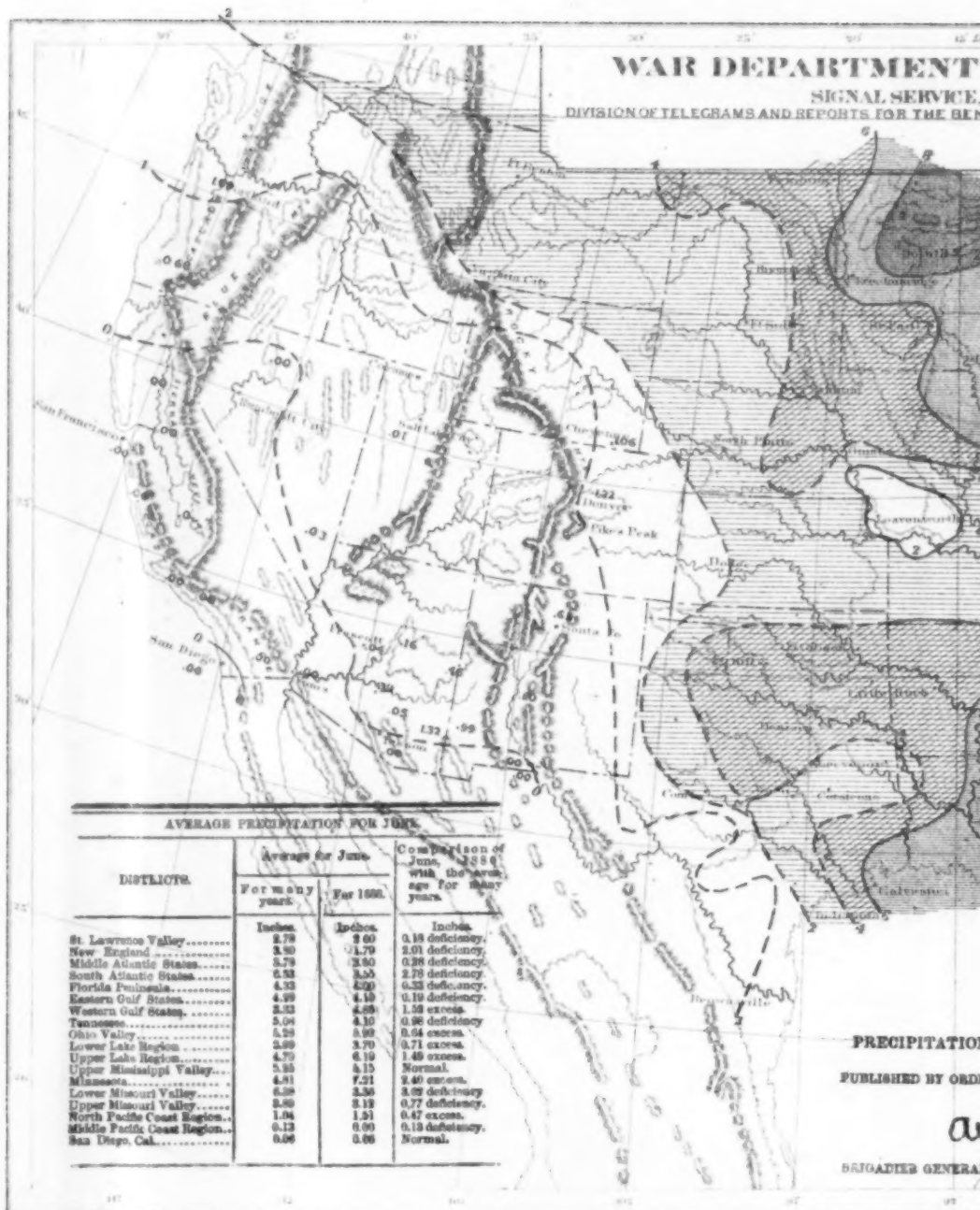
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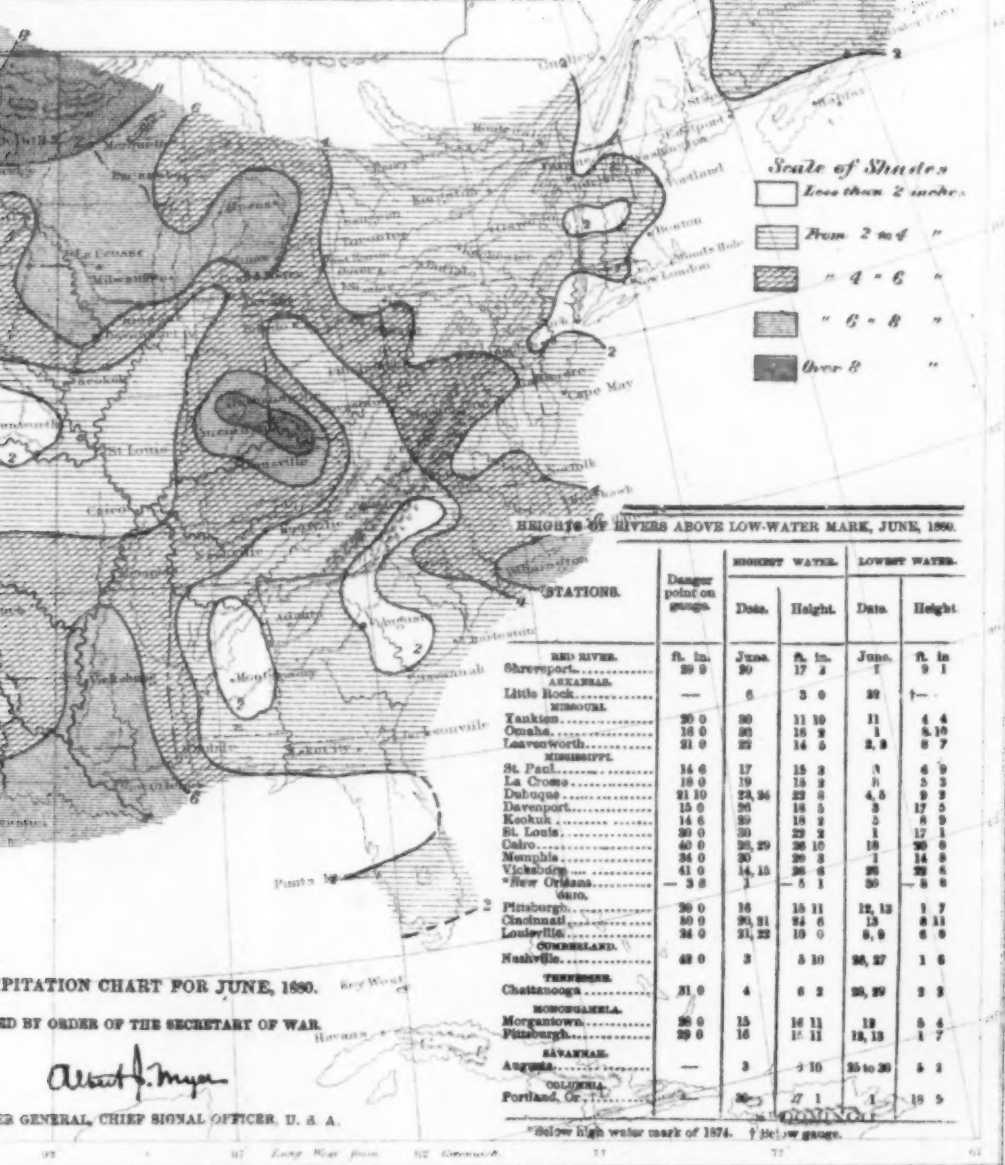
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No. III.

WEATHER MAP. SERVICE, U.S. ARMY. THE BENEFIT OF COMMERCE AND AGRICULTURE.



PITATION CHART FOR JUNE, 1880.

ED BY ORDER OF THE SECRETARY OF WAR.

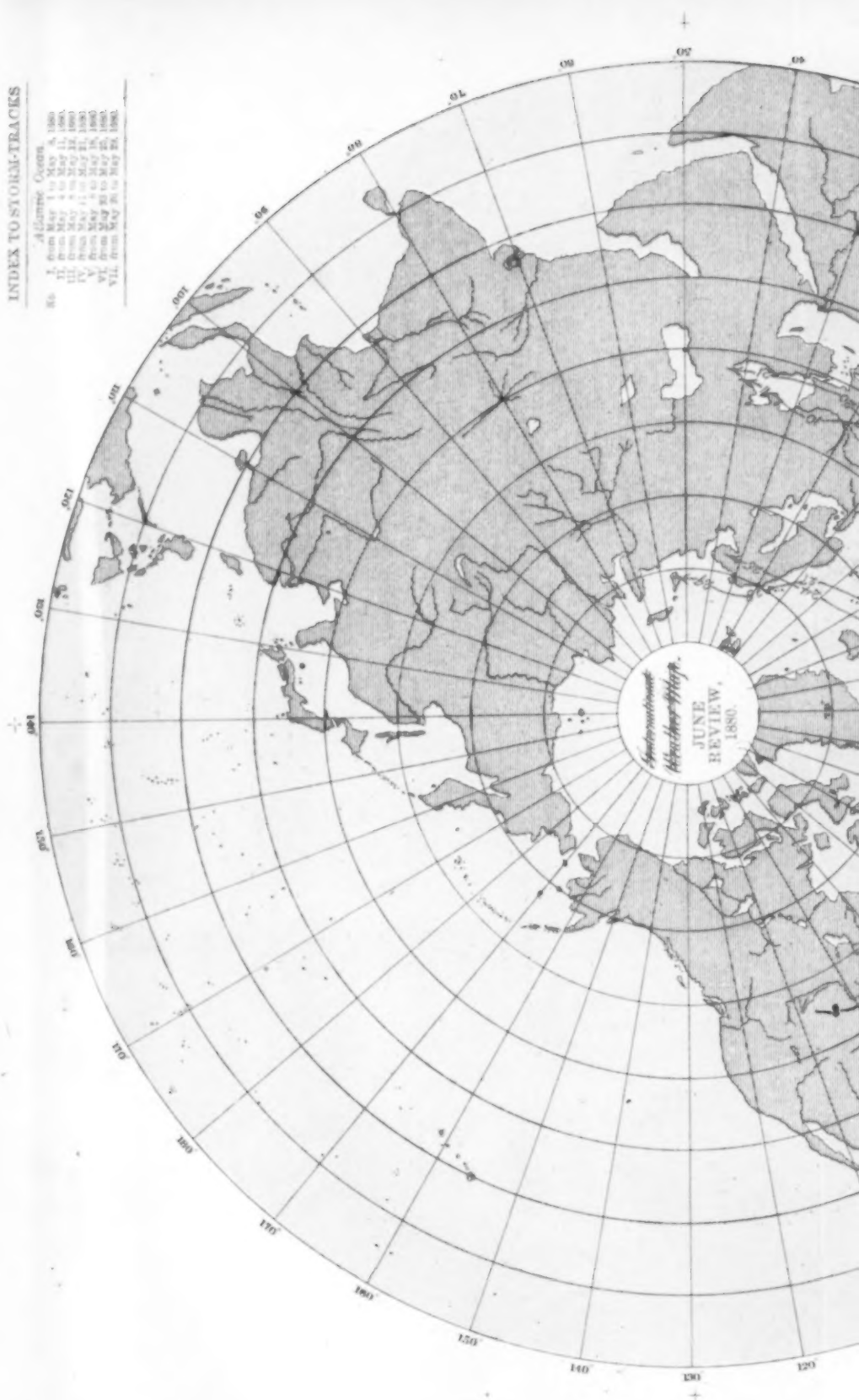
Albert J. Myer

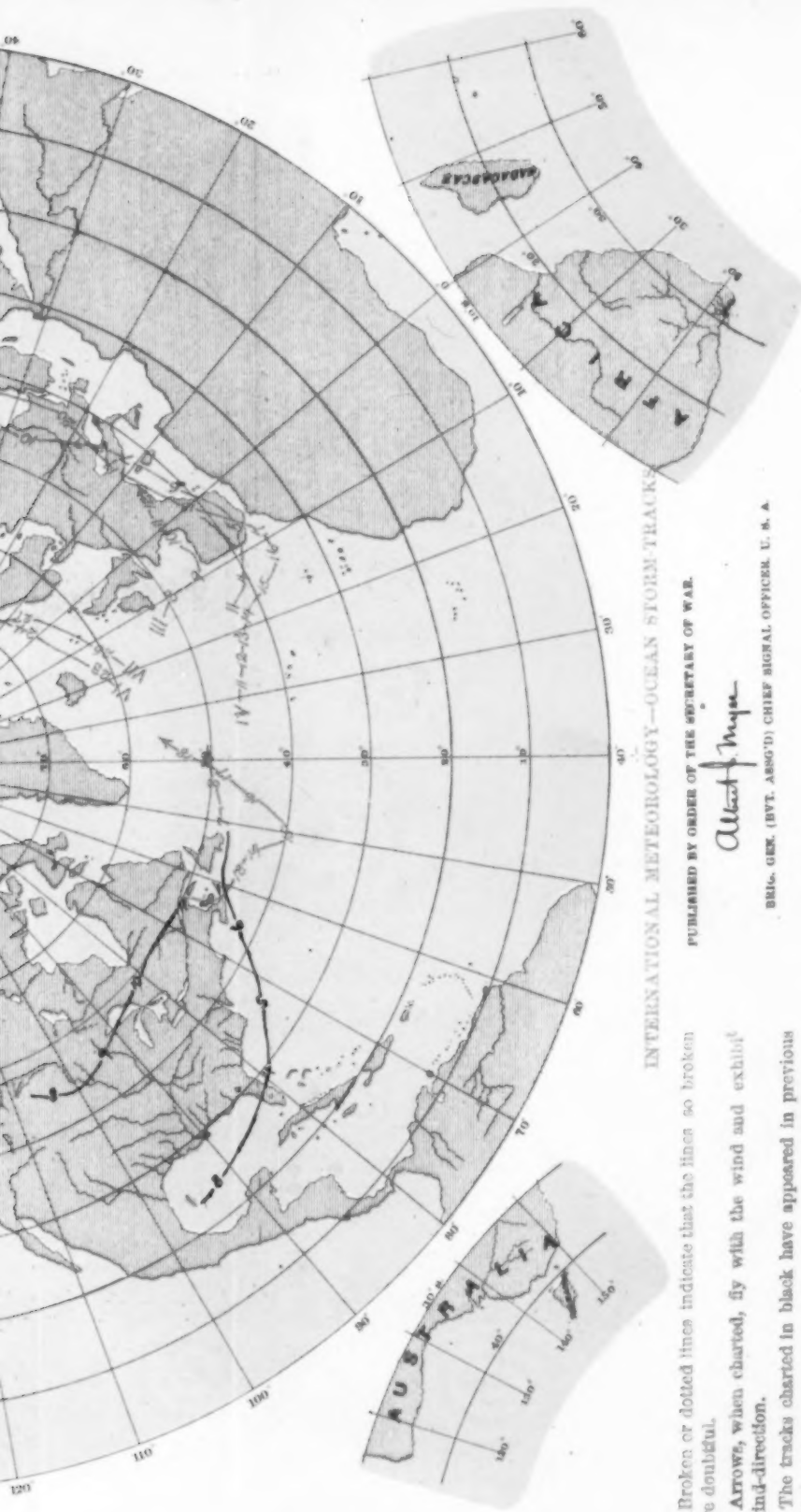
ER GENERAL, CHIEF SIGNAL OFFICER, U. S. A.

CHART No. IV.

INDEX TO STORM-TRACKS

Atlantic Ocean.	
I.	from May 1 to May 5, 1880
II.	from May 6 to May 12, 1880
III.	from May 13 to May 21, 1880
IV.	from May 22 to May 28, 1880
V.	from May 29 to May 35, 1880
VI.	from May 36 to May 42, 1880
VII.	from May 43 to May 49, 1880





INTERNATIONAL METEOROLOGY—OCEAN STORM TRACKS

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Alfred Meyer

BRIG. GEN. (BVT. ARSG'D) CHIEF SIGNAL OFFICER, U. S. A.

Broken or dotted lines indicate that the lines so broken are doubtful.

Arrows, when charted, fly with the wind and exhibit wind-direction.

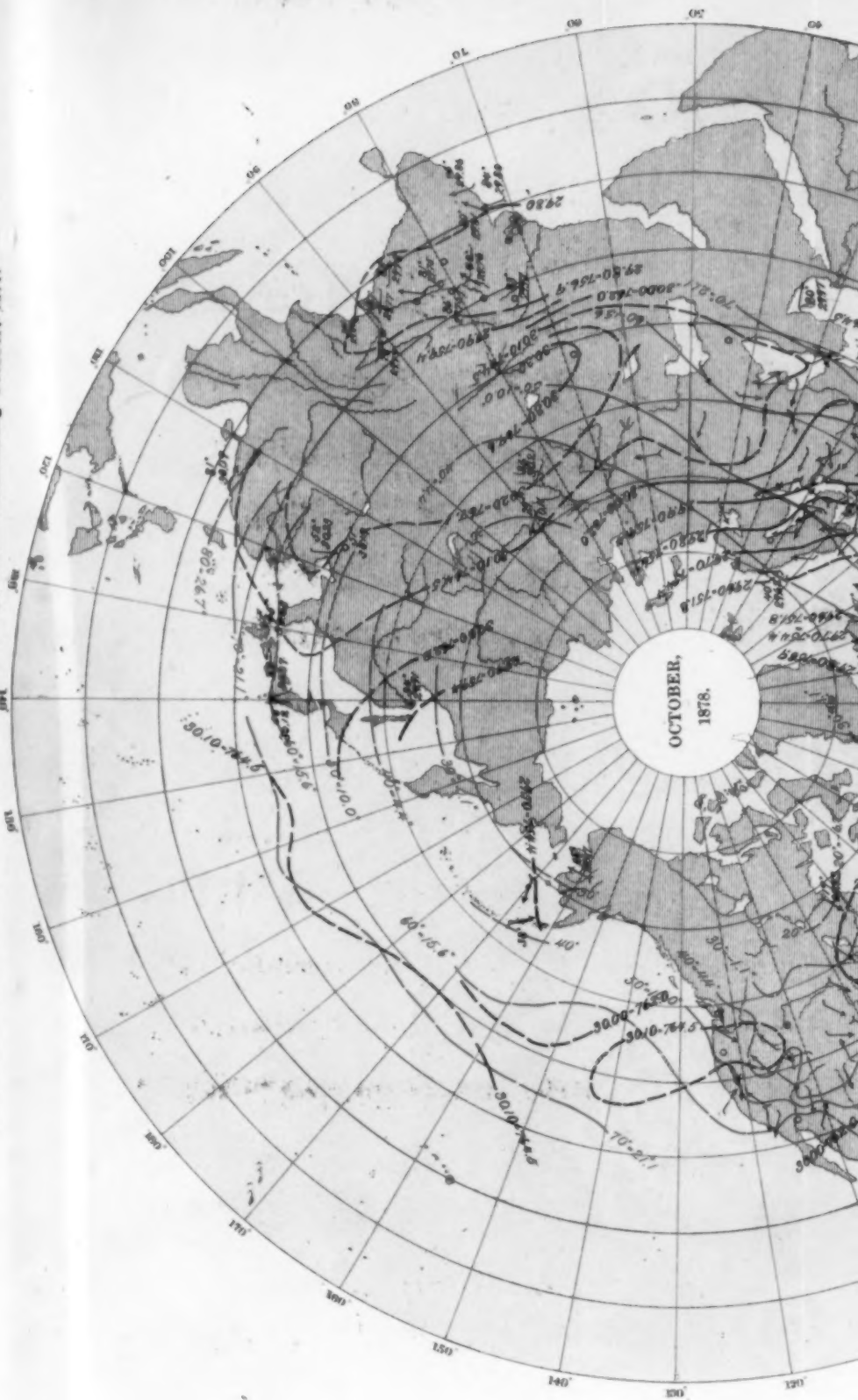
The tracks charted in black have appeared in previous Reviews.

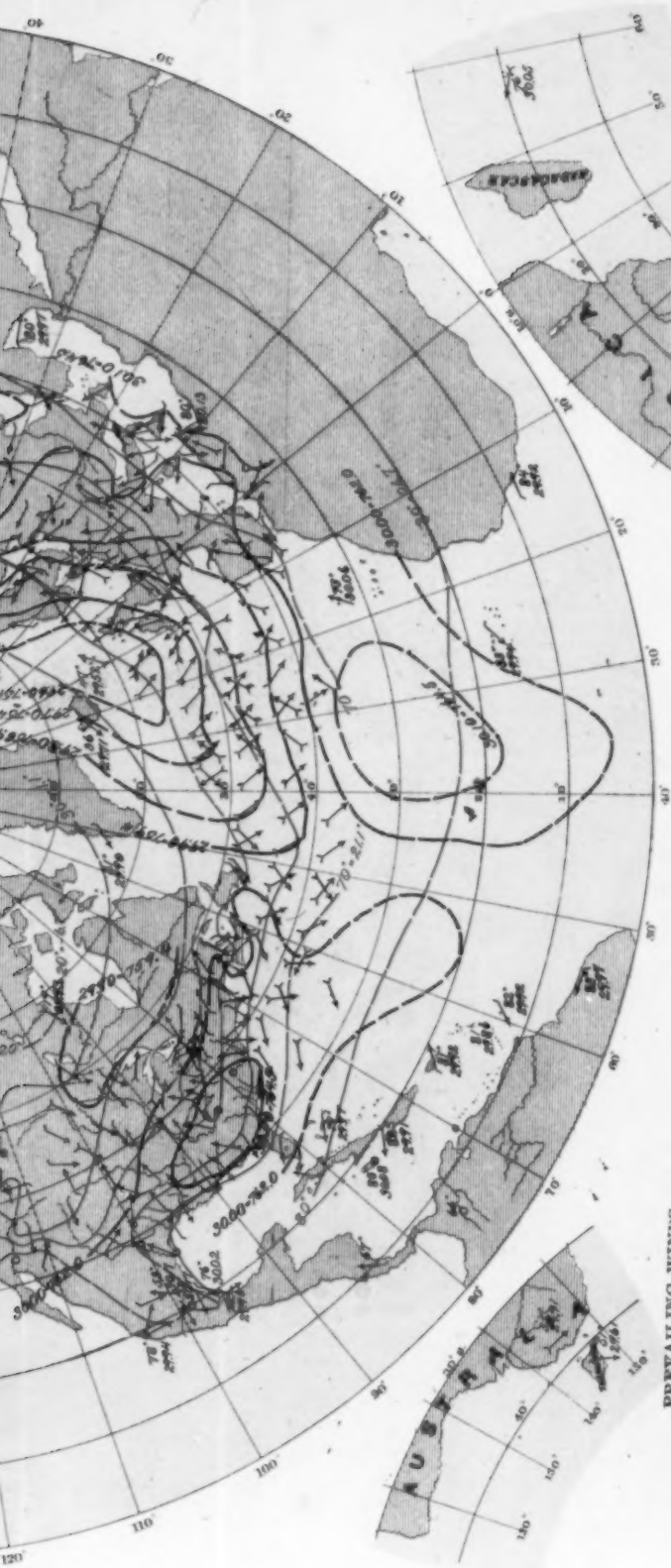
The tracks charted in red have been made from data collected since preceding Review.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing October, 1877.





PREVAILING WINDS.

Arrows show the direction of, and fly with, the wind
Force is shown as follows:

SYMBOLS.	FORCE.	VELOCITY.	
		Miles per hour.	Metres per second.
↑	1, 2	0 to 9	0 to 4.0
↑↑	3, 4	9.1 to 22.5	4.1 to 10.1
↑↑↑	5, 6	22.6 to 40.5	10.1 to 18.1
↑↑↑↑	7, 8	40.6 to 67.5	18.1 to 30.2
↑↑↑↑↑	9, 10	67.6 up.	30.2 & over.

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Albert H. Myer

BRIG. GEN. (BVT. ASSO'D) CHIEF SIGNAL OFFICER, U. S. A.

ISOBARS AND ISOTHERMS.

Isobars in *blue*; detached barometer means in English inches.

Isotherms in *red*; detached temperature means in degrees Fahrenheit.

Broken lines are doubtful.

INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of October, 1878, based on the daily charts of the International Bulletin.

No. VI.

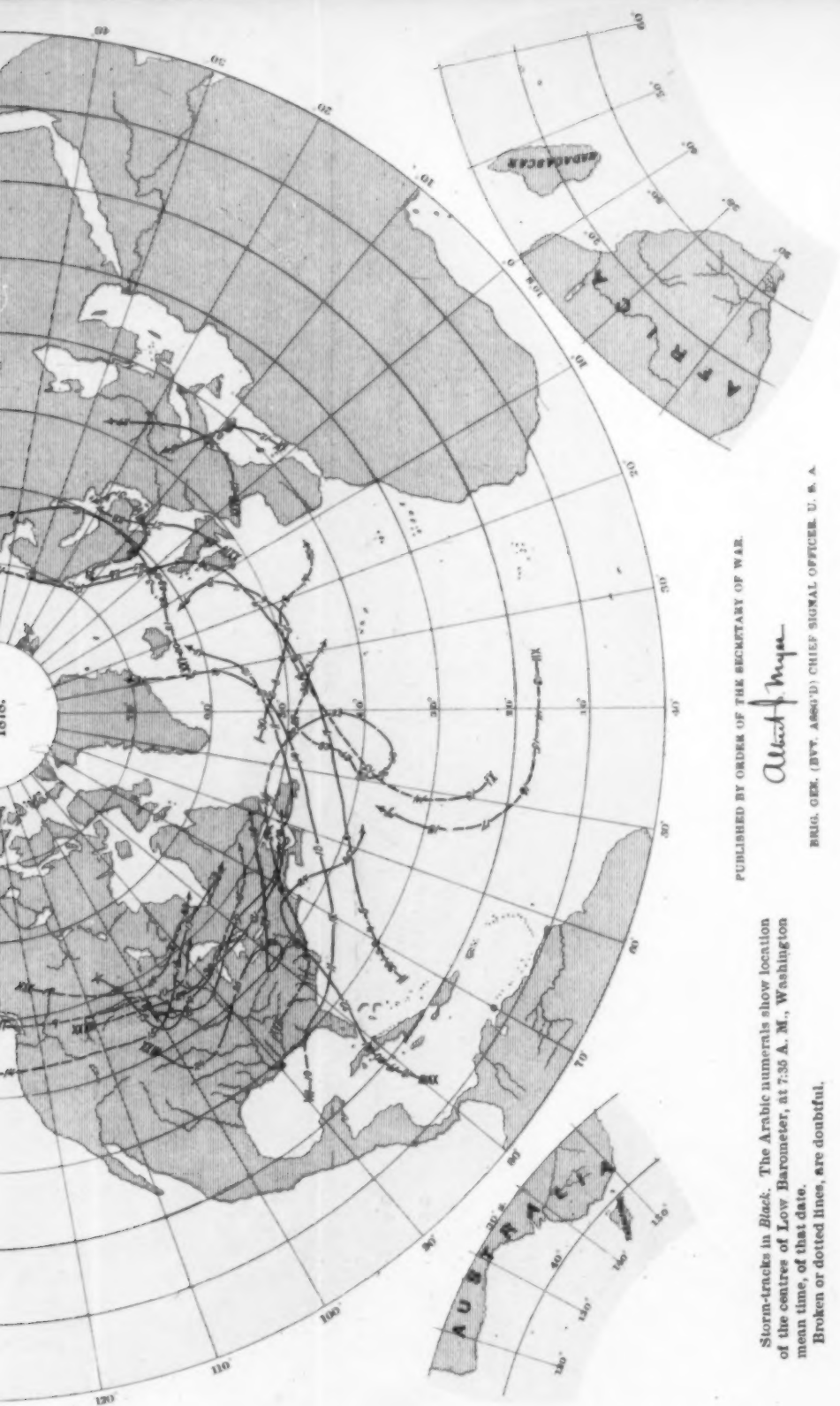
Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing September, 1877.



1015.



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Albert H. Meyer

BRIG. GEN. (REV. ARMY) CHIEF SIGNAL OFFICER U. S. A.

Storm-tracks in Black. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date. Broken or dotted lines, are doubtful.

INTERNATIONAL CHART.

Showing Tracks of Centres of Low Barometer for October, 1878.